AM7
Central Office Simulator
Instruction Manual



Ameritec
CORPORATION

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Instruction Manual

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01	January, 1987	Preliminary Issue. Incorporated Engineering comments.
A	August, 1988	PCM Addendum
B	September, 1993	SLC®96 Addendum
C	July, 1997	Rewritten and Reformatted
D	May 11, 1998	E&M Linecard SW2 Settings were revised (pg. 1-15).
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1. INTRODUCTION

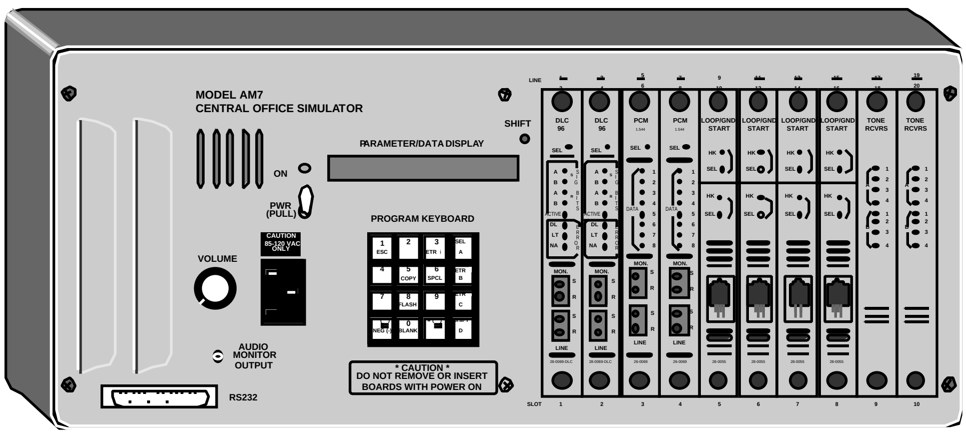


Figure 1-1. AM7 Central Office Simulator

The Ameritec AM7 Central Office Simulator is a simulator of Central Office switches, PABX switches, or the Public Switched Telephone Network (PSTN). The AM7 is user-programmable, allowing realistic testing when an actual switch is not available. It is a self-contained, compact, lightweight unit which is easily hand carried, or can be rack mounted for laboratory use.

The AM7 mainframe is a miniature, high performance, non-blocking digital switch. It is capable of switching up to 48,000 calls per hour, and has 10 option card slots for installation of plug-in interfaces. Interface options include:

- 1 - 10 Analog Loop/Ground Start linecards
- 1 - 10 Dual Line Analog E & M linecards
- 1 - 4 Single Line T1 PCM linecards and/or Single Line DLC linecards
- 1 - 7 Tone Receivers for decoding MF and DTMF digits for use with PCM or DLC interfaces

The AM7 is easily configured to simulate a variety of CO or PABX switches. This allows testing to be performed in development or manufacturing environments without having to connect lines to a live switch.

- The Analog line interface options for the AM7 make it perfect for testing of Customer Premises Equipment (CPE), particularly in development, manufacturing, and repair areas.
- The PCM line interface option allows testing of CPE or switching equipment with T1 interfaces, and when used in combination with Analog linecards, allows the AM7 to simulate the subscriber and trunk functions of a switch.
- The DLC option allows the AM7 to fully simulate a COT, making the AM7 perfect for installation testing of SLC®96 Remote Terminals (RTs).

The portability of the AM7 allows use in the field to test or install CPE or other equipment. The ability to remote control the AM7 via a built in RS-232 port makes it suitable for automated test applications in the laboratory.

1.1 AM7 User Manual Overview

The AM7 is a very versatile unit that is used in different environments throughout the world. As a result, no manual could be written to exactly match your testing requirements. Instead, a Getting Started Section with generalized applications has been written. These applications include step-by-step instructions that you can modify to meet your testing needs. The following is a summary of the manual's contents by section.

Table of Contents contains a detailed Table of Contents, List of Figures, and List of Tables.

Section 1, Introduction, provides an overview of the basic functionality of the unit. It shows the location and layout of the front panel and describes its components. It also discusses cabling, power, options, and accessories.

Section 2, Getting Started, provides information regarding Unpacking, Power On/Off, Memory Backup, and AM7 operation.

Section 3, System Setup and Programming, introduces System and Line parameters, Dialing Analyzer parameters, and Action Codes.

Section 4, Programming Examples and Tests, provides examples of AM7 Dialing Code programming, and various switching and test applications that may be accomplished by means of the programming.

Section 5, Reports, lists and describes both the Automatic Unit Data Register and User Requested reports, including report parameters and available options.

Section 6, Remote Control/Chaining, describes the method of remotely controlling the operation and printing of reports from the AM7. It also provides information regarding the "chaining" together of multiple AM7 units.

Section 7, Technical Specifications, is to be consulted for an overview of the AM7's capabilities and operating parameters.

Section 8, Warranty and Service, provides warranty, calibration, service, and repair information for the AM7.

Section 9, Glossary, contains a list of acronyms or abbreviations used in this manual.

Section 10, Index, provides an alphabetical listing of all topics.

In this manual slashed zeroes (ø) are used to distinguish the number zero from the letter "O" when entering RS-232 commands or representing displayed values. Elsewhere slashed zeroes are only used if there's a chance confusion would result if they weren't used.

1.2 Physical Description

The AM7 is furnished in a portable bench top case with accessory brackets for rack mount applications. The portable AM7 consists of a rugged fiberglass carrying case, containing a frame assembly that houses the system's printed circuit boards and interface cards. A front panel is attached to the frame assembly to provide the user interface. The rear of the unit provides no controls or access.

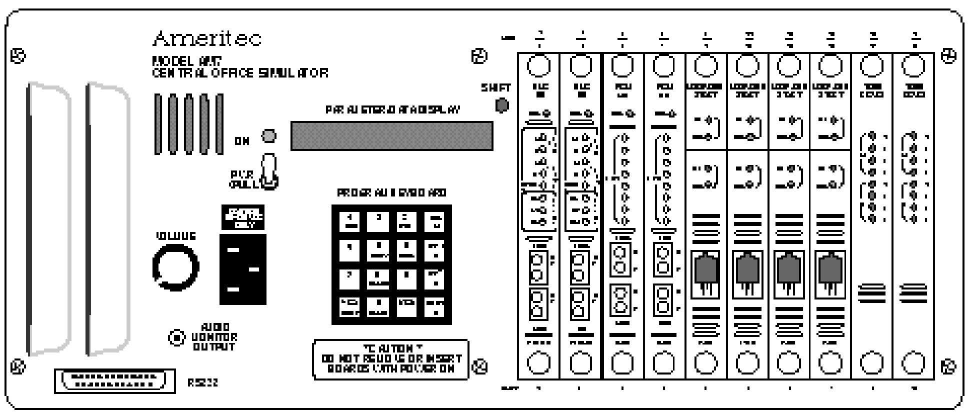


Figure 1-2. AM7 Front Panel

1.3 Front Panel

The front panel of the AM7 provides all the controls and connectors for the unit and hosts an assortment of up to ten line cards.

1.3.1 Fan Exhaust/Speaker Vents

Two air vents required for the internal cooling fan are located on the left edge of the AM7 front panel. Five slotted vents required for the AM7 Speaker appear immediately to the right of the air vents.

1.3.2 RS-232 Connector

Each AM7 is equipped with an EIA RS-232C digital interface located in the lower left corner of the front panel. It is compatible with most serial ASCII printers, CRT's, PC's, and modems.

Certain pins in the DB-25 male connector must be tied together for proper system operation. If a terminal is directly connected to the AM7, the Ameritec Universal Printer Cable, or equivalent, is required.

The jumpers must always be installed between the Special function pins, due to proprietary communications techniques that allow the AM7 units to be "chained". The ASCII device connected to the AM7 only deals with pins 2, 3, and 7 and is not involved with the Special function pins. Please see the Remote Control Operation section of this user's manual for details regarding RS-232C operation.

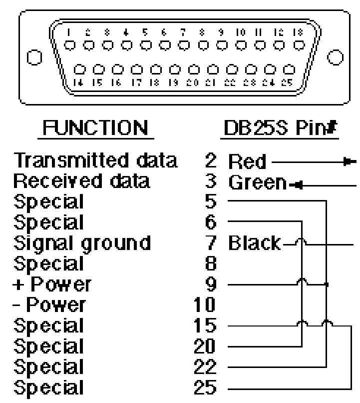


Figure 1-3. RS-232C Interface

1.3.3 Audio Monitor Output/Volume Control

The Audio Monitor Output and Volume Control are located just above the RS-232 connector on the front panel. The Volume Control controls the Audio Monitor Output volume for any of the lines that can be installed in the AM7.

The Audio Monitor Output jack (industry standard TRS bantam) is automatically connected to the line selected from the keypad. The output is suited for connection to a Transmission Test Set for noise, level, and frequency measurements of the selected line's tones.

1.3.4 Power Connection

The AM7 is powered from an AC source of 108-125VAC, 50/60Hz, or 210-230VAC, 50/60Hz, 50W max. The Power Connection consists of a standard V-type connector and is located just to the right of the Volume Control. The power supply automatically adjusts the line voltage and frequency.

Note: The non-volatile memory is maintained by a lithium battery with a longevity of about six years continuous operation.

1.3.5 Power Switch and Power Indicator

The Power Switch is a knob-type on/off switch that must be pulled out during switching. It is located just above the Power Connection. An LED, located immediately above the Power Switch, glows green when power is applied to the AM7 and the unit is switched on.

1.3.6 Parameter/Data Display and Shift Indicator

The Parameter/Data Display is a 16-digit alpha-numeric LED display, presenting red characters on a black background. The AM7 has a number of parameters unique to the overall system and offers a wide variety of parameters that may be applied to each individual line. The Parameter/Data Display allows you to view the values in each data register, permitting changes to be made in the operating parameters via the Program Keyboard. Each parameter value is discussed in greater detail in the section on Getting Started.

A value containing a decimal point is displayed without one (35.1 is displayed as 351, for example).

An LED is located just above the upper right-hand corner of the Parameter/Data Display. The LED glows red when the SHIFT key on the Program Keyboard is pressed. The LED goes dark only after the next key is pressed.

1.3.7 Program Keyboard

The Program Keyboard is used to program and set up the AM7. It is a multi-function, two color, 16-key keypad, that initiates primary (black type) and secondary (red type) functions. Secondary functions are accessed by pressing the SHIFT key, then pressing the required secondary function key. They can also be performed through a terminal keyboard. The keypad and terminal keyboard commands are provided below.

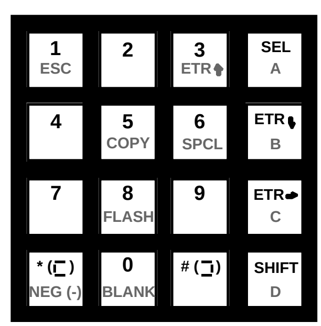


Figure 1-4. Program Keyboard

1.3.7.1 Primary Key Functions

The primary key (black type) functions are listed below.

Table 1-1. Primary Key Functions

Front Panel Key(s)	Description
1 thru 0	Number keys - Enter digits 1 thru 0
SEL	Select key - Selects system, line, and dial code parameters, which may be altered by changing the data in the displayed registers SEL + 000 + ETR🡻 = System Parameters SEL + 001 thru 020 + ETR🡻 = Analog Line Parameters SEL + 100 thru 400 + ETR🡻 = PCM Line Parameters SEL + 0A1 thru 4D8 + ETR🡻 = Dialing Code Parameters
ETR🡻	Enter-B key - Enters data after it has been typed in using the number/ symbol keys, or enters a parameter and steps to the next one
ETR➔	Enter-C key - Enters data after it has been typed in using the number/ symbol keys, or enters a parameter and steps to the next line at the same program parameter
*([ )	Represents either a KP digit (MF receiver enabler) for MF operations or an asterisk for DTMF operations. Entered by pressing the *([ ) key. The digit is represented by an asterisk on the display
#( ])	Represents either an ST digit (MF receiver disabler) for MF operations or a pound sign for DTMF operations. Entered by pressing the #( ]) key. The digit is represented by a pound sign on the display
SHIFT	Shift key - Enables secondary function keys to operate

1.3.7.2 Secondary Key Functions

Secondary key (red type) functions are enabled via the Shift key.

Table 1-2. Secondary Key Functions

Front Panel Key(s)	Description
ESC	Escape key - Escapes present operation or discards the present entry
ETR↑	Enter-3 key - Enters data, and back-steps to the previous parameter
A to D	A thru D keys - Enter their respective letters DTMF MF A ST3P B STP C ST2P D - -
COPY	Copy key - Copys programmed data from one line to another line or all lines within the analog lines, or copies within a particular span, not between spans
SPCL	Special key - Provides special secondary functions SHIFT + SPCL + 1 + ETR↓ = Print parameters associated with the selected area (System, Line, or Dialing Code SHIFT + SPCL + 2 + ETR↓ = Print all parameters and data registers SHIFT + SPCL + 3 + ETR↓ = Print data registers SHIFT + SPCL + 4 + ETR↓ = Reset all data registers SHIFT + SPCL + 5 + ETR↓ = Reset the selected line's (001-020, 101-124, 201-224, 301-324, 401-424) data registers SHIFT + SPCL + 6 + ETR↓ = Stores up to 4 System, Line, and Dialing Code parameter scenarios for later recall SHIFT + SPCL + 7 + ETR↓ = Recalls up to 4 previously stored System, Line, and Dialing Code parameter scenarios from memory

Front Panel Key(s)	Description
SPCL	SHIFT + SPCL + 8 + ETR🡻 = Print Dialing Codes for all installed lines and PCM cards SHIFT + SPCL + 9 + ETR🡻 = Print data for selected analog line or selected PCM card (See Section 5, Reports, for the detailed operation of SPCL keys)
FLASH	Flash key - Inserts a flash function into a dial number sequence to expect a momentary On-Hook signal. The Flash function is denoted by the letter F in the field of the dialed number
NEG (-)	Negative key - Makes a value negative, and is used to program a DTMF or MF twist limit. It is also used to enter a "don't care" digit in the dial code, expected digits field
BLANK	Blank key - inserts a blank digit (space)

1.3.7.3 Terminal Keyboard Operation

Operation of the AM7 through an ASCII terminal keyboard is similar to normal operation through the keypad at the front panel. Examples of connecting an AM7 to an ASCII terminal are shown in the following figures.



Figure 1-5. Terminal Keyboard Connection (ASCII)

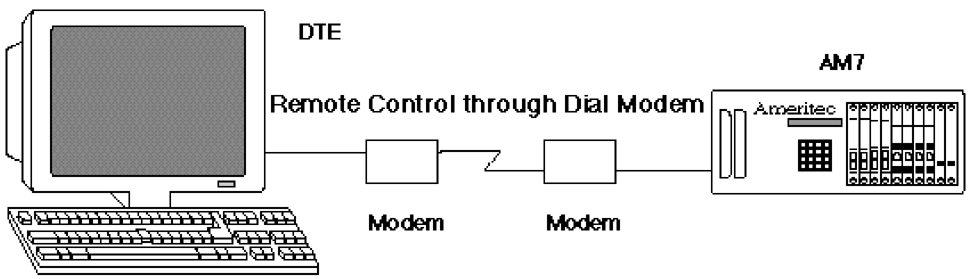


Figure 1-6. Terminal Keyboard Connection (Remote)

The terminal keyboard keys are used to access data registers in order to set AM7 operating parameters. There are exceptions to the similarities of the keyboard and the keypad, and these are provided below.

CAUTION: Set and keep the keyboard in Caps Lock (Alpha Lock).

Table 1-3. Terminal Keyboard Definitions

Keypad Key	Keyboard Equivalent	Keypad Key	Keyboard Equivalent
0 to 9, * and #	0 to 9, * and #	Select	A
Enter-B	B or Return key	Enter-C	C or Line-Feed key
Enter-3	D3	Shift	D
Escape	D1 or E	Copy	D5
Special (SPCL)	D6	Flash	D8 or F
Negative (NEG)	D* or -	Blank	D0 or Space key
A	DA	B	DB
C	DC	D	DD

1.3.8 Interface Port Cards

The AM7 is capable of housing from 1 to 10 of the following interface port cards. Various mixes of options are possible, up to the 10 slot maximum:

- Dual Line Analog Loop/Ground Start linecards — Up to 10 cards
- Dual Line Analog E&M linecards — Up to 10 cards

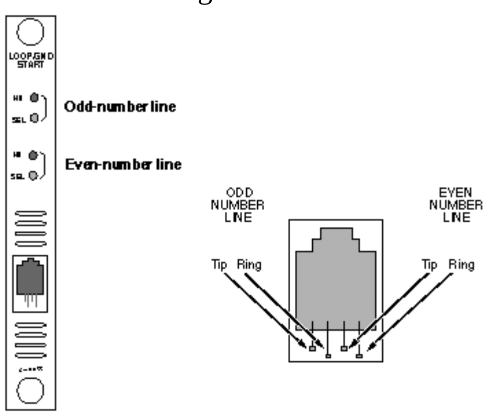


Figure 1-7. Loop/Ground Start Linecard (28-0055)

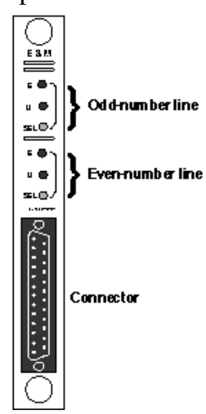


Figure 1-8. E&M Linecard (28-0059 TT/28-0055 MF)

- Single Line T1 PCM and/or DLC linecards — Up to 4 cards
- Tone Receiver Cards — Up to 7 cards

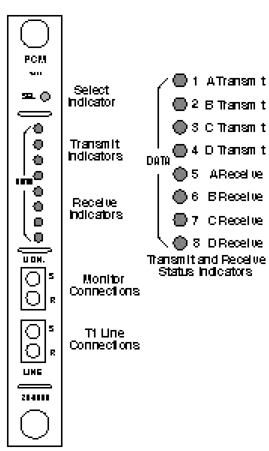


Figure 1-9. PCM Linecard (28-0069)

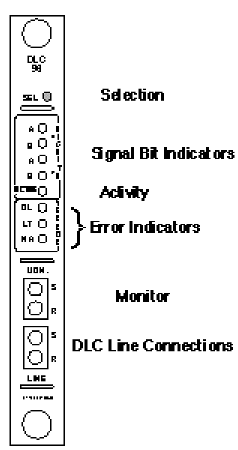


Figure 1-10. DLC Linecard (28-0069-DLC)

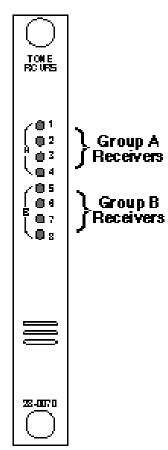
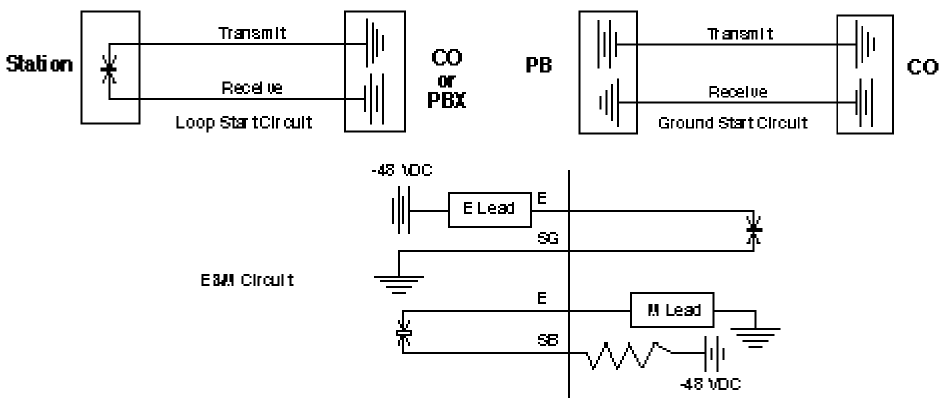


Figure 1-11. Tone Receiver (28-0070)

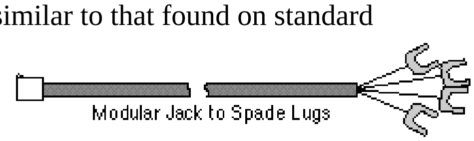
The AM7 Loop/Ground Start line 2-wire analog interface provides two independent lines. Each line can originate and/or receive calls. The 2 and 4-wire E&M line interface provides 2 independent lines. Each line can originate and/or receive calls. The 4-wire T1 line interface (PCM) provides a send pair and receive pair of contacts. It is capable of Loop/Ground Start, and E&M interface emulation. The DLC card provides for the testing of SLC®96 equipment.



The types of cables used for the Interface Port Cards vary from card to card. Cables are illustrated, along with their pin assignments. Each of the Interface Port Cards is provided with a DIP switch(s) for the selection of Card Slot Numbers and in some cases, particular card features.

1.3.8.1 Dual Line Analog Loop/Ground Start linecards

The Loop/Ground Start linecard is a two-wire analog interface that provides two independent lines, both capable of originating and receiving calls. One line is assigned an odd number, the other an even number. Each card has two sets of LED indicators, the top set for odd-numbered lines, the bottom set for even-numbered lines. A modular connector similar to that found on standard telephone handsets is located on the front of the card and can support three different types of line cables.



P/N 48-0004

The Loop/Ground Start linecard contains 2 DIP switches, SW1 and SW2. SW1 is used to select the interface port card slot number. The AM7 can accept up to 10 interface port cards. Each card is identified from the address selected on this switch. If two cards are set to the same address, the AM7 will not operate properly. The default settings depend on the card slot assignment. The SW2 selections indicate either loop start or ground start operation for each of the two lines on that interface port card. The default setting is for Ground Start (both switches in the off position).

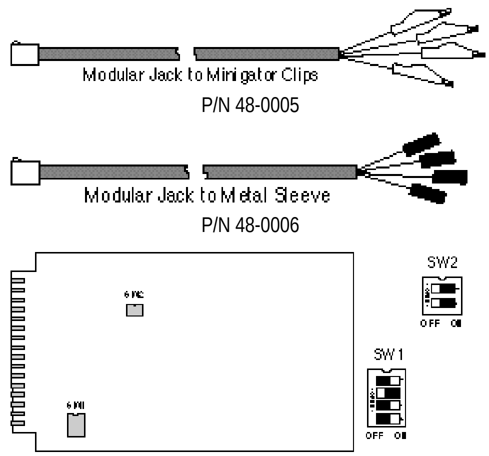


Figure 1-12. Loop/Ground Start DIP Switches

Table 1-4.Loop- and Ground-Start Linecard SW1 Settings

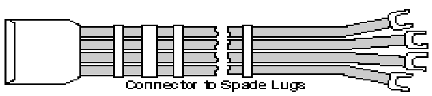
Switch	Slot 01	Slot 02	Slot 03	Slot 04	Slot 05	Slot 06	Slot 07	Slot 08	Slot 09	Slot 10
1	On	Off	On	Off	On	Off	On	Off	On	Off
2	Off	On	On	Off	Off	On	On	Off	Off	On
3	Off	Off	Off	On	On	On	On	Off	Off	Off
4	Off	Off	Off	Off	Off	Off	Off	On	On	On

Table 1-5. Loop- and Ground-Start Linecard SW2 Settings

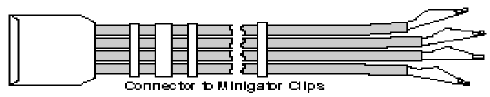
Switch	Function	On Position	Off Position
1	Odd-number line	Loop Start	Ground Start
2	Even-number line	Loop Start	Ground Start

1.3.8.2 Dual Line Analog E&M linecards

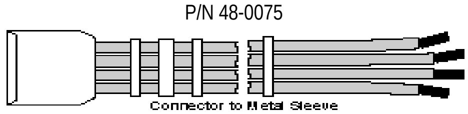
There are two types of E&M linecards; one for decoding Dial Pulse and/or DTMF digits (P/N 28-0059 TT) and one for decoding Dial Pulse and/or MF(R1) digits (P/N 28-0059 MF). The two- and four-wire E&M linecard provides two independent lines, both capable of originating and receiving calls. One line is assigned an odd number, the other an even number. Each card has two sets of LED indicators, the top set for odd-numbered lines, the bottom set for even-numbered lines. A 25-pin, D sub-miniature connector is located on the front of the card and can support three different types of line cables. Two types of E&M Interface cables are available, a regular 25 pin, D Sub-miniature connector, and



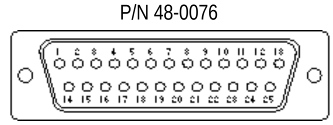
P/N 48-0075



P/N 48-0076



P/N 48-0077



an Inter-AM7 dual 7 E/M cable for an E&M Type 5 Interface.

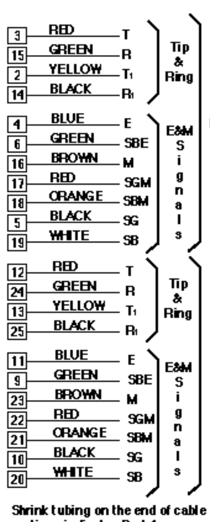


Figure 1-13. E&M Cable

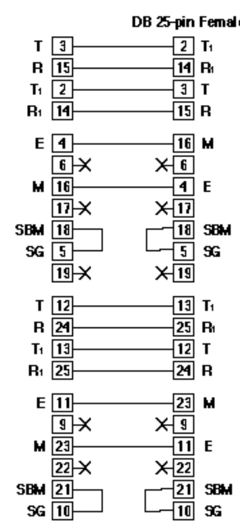


Figure 1-14. E&M Type 5 Cable

The two types of E&M linecards (2- and 4-wire) contain 4 DIP switches (SW1 thru SW4). The SW1 selections indicate the card slot number as previously shown. Default settings depend on the card slot assignment.

The SW2 four position DIP switch selects one of four Start Signals for each E&M line. The Start Signal is generated by the AM7 in response to an incoming line seizure.

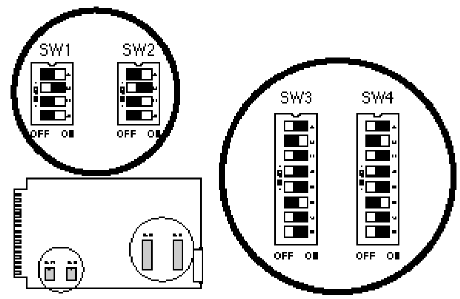


Figure 1-15. E&M Linecard DIP Switch Locations

Table 1-6. E&M Linecard SW2 Settings

Start Signal	Immediate	Delay	Wink	Dial Tone	
1	Off	On	Off	On	**Odd Line**
2	Off	Off	On	On	**Odd Line**
3	Off	On	Off	On	**Even Line**
4	Off	Off	On	On	**Even Line**

Note: Switch positions 1 and 2 control selections for the ODD numbered line. Switch positions 3 and 4 control selections for the EVEN numbered line.

The SW3 eight position DIP switch selects both Audio Path gain and 2- or 4-wire card configuration independently for each line.

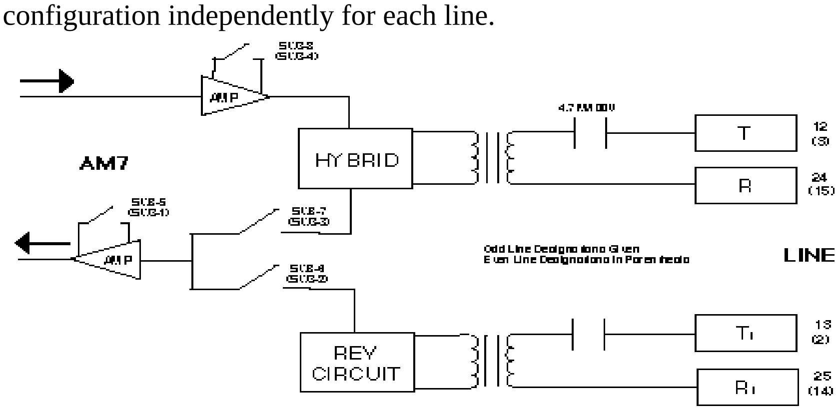


Figure 1-16. Dial Pulse and DTMF E&M Line Interface Port Card

Table 1-7. E&M Linecard SW3 Settings

Selection	1 5	2 6	3 7	4 8	EVEN Line Odd Line
2-Wire Mode		Off	On		
4-Wire Mode		On	Off		
0dB Gain AM7 to Line				Off	
-16dB Gain AM7 to Line				On	
0dB Gain AM7 from Line Off	Off				
-7dB Gain AM7 from Line On	On				

The SW4 eight position DIP switch selects the type of E&M Signaling Interface for each line.

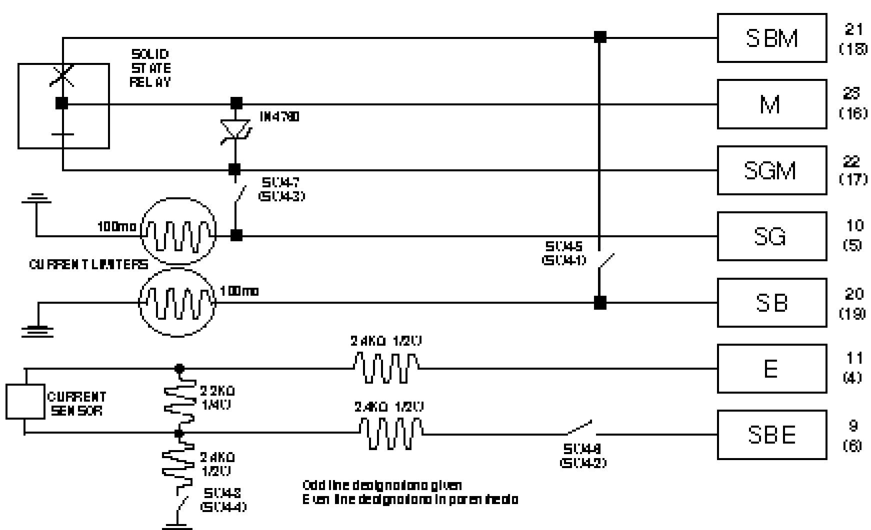


Figure 1-17. Dial Pulse and MF E&M Interface Port Card

Table 1-8. E&M Linecard SW4 Settings

Interface Type	1 5	2 6	3 7	4 8	EVEN Line Connections Odd Line Connections
1	On	Off	On	On	M, E
2	Off	Off	Off	On	M, SBM, E, SG
3	Off	Off	Off	On	M, SGM, SBM, E
4	Off	Off	Off	On	M, SBM, E, SG
5	Off	Off	Off	On	M, E; Connect SG to SBM

> **Caution:** Before connecting a cable configured for a Type 5 E&M interface, make sure the SW4 switch positions are properly set. Failure to comply may result in serious damage to the equipment.

1.3.8.3 Single Line PCM linecards

The Single Line PCM linecard provides access to 24 digital T1 channels, capable of handling one call per channel. Each card has a set of 9 LED indicators, including a green SEL (select) indicator and eight red DATA (1-4 transmit and 5-8 receive) indicators. The PCM linecard provides the AM7 with a 4-wire T1 line interface with a send and receive pair of contacts. The connection is made through a Bantam jack, one for each pair of "LINE" contacts. An additional pair is used for line monitoring. The PCM linecard contains one DIP switch, SW1. The SW1 selections indicate the formatting of the card, the type and length of cable used, and the card slot number. The card may be formatted for either an Extended Super Frame (ESF) or D4 function by setting SW1 switch 1 ON to select ESF operation.

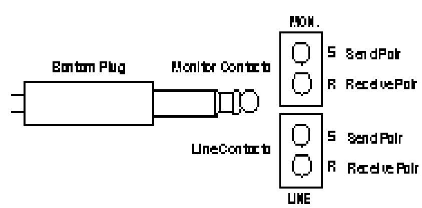


Figure 1-18. T1 Line Interface

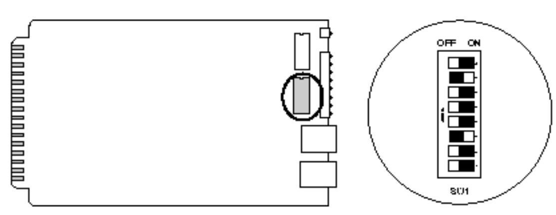


Figure 1-19. PCM Linecard DIP Switch Locations

SW1 switch 1 is set to OFF to select D4 operation. The PCM linecard is capable of utilizing MAT, ICOT, ABAM, PIC, or PULP cables of varying lengths for data transmission and reception. SW1 switches 2 thru 4 are used to designate the cable type and length.

Table 1-9. PCM Cable Length/Type Selection

DIP Switch Settings			Line Length	Cable Type
2	3	4		
On	On	Off	0 to 220 ft.	MAT & ICOT
On	On	Off	0 to 150 ft.	ABAM, PIC and PULP
Off	Off	On	150 to 275 ft.	
On	Off	On	275 to 550 ft.	
Off	On	On	550 to 655 ft.	

SW1 switches 5 and 6 are not used. The SW1 switch 7 and 8 selections indicate the card slot number.

Table 1-10. PCM Linecard Slot/Span Selection

DIP Switch Settings		PCM Card Slot	Span #
7	8		
Off	Off	Slot 1	1
On	Off	Slot 2	2
Off	On	Slot 3	3
On	On	Slot 4	4

1.3.8.4 Single Line DLC linecards

The Single Line DLC linecard provides access to 24 digital channels on each of 4 Spans, capable of handling one call per channel for a total of 96 calls. Each card has a set of 9 LED indicators, including a green SEL (select) indicator, four red bit status (SIG BITS) indicators, a red activity (ACTIVE) indicator and three red ERROR indicators. Two sets of 2 Bantam jacks are provided for a SLC®96 line interface; one set (LINE) for send (S) and receive (R) on the line, and one set (MON.) for monitoring the line.

The DLC linecard has an internal DIP switch that is the same as shown for the PCM linecard. The DIP switch (SW1) must be set correctly before the DLC linecard is installed in a slot. Two modes of operation are available, Mode I Option and Mode II Option.

The Mode I Option requires the installation of from 1 to 4 DLC linecards in slots 1 to 4 in the AM7. Each DLC linecard can send and receive 24 Mode I channels on Spans A, B, C, or D. The Mode II Option requires DLC linecards to be installed in slots 1 and/or 3. DLC cards that are installed in slots 2 and 4 are not operational for the Mode II Option. Channels 01 thru 48 and alarms are processed by Span A (Slot 1). Channels 49 thru 96 are processed by Span C (Slot 3). If PCM linecards are installed in slots 2 and/or 4, they must be removed to permit Mode II operation.

The DLC linecard cannot decode multi-frequency tones; therefore, at least one Tone Receiver card must be installed for each DLC linecard installed.

1.3.8.5 Tone Receiver Cards

The Tone Receiver cards are shared as tone receivers in a central office switch. When a T1 line programmed for tone dial (or tone dial and dial pulse) has an incoming seizure (off-hook), a TT or MF receiver (whichever that line has been set to decode) must be available before the start dial signal is returned. There are a possible total of 8 MF receivers or 6 TT receivers on each card. The receivers are divided into 2 groups "A" receivers and "B" receivers. Each receiver group is independently programmed to decode either TT or MF. If a receiver group is programmed to decode MF digits, 4 receivers are available. If a receiver group is programmed to decode TT digits, 3 receivers are available. One Tone Receiver card is required to decode TT or MF digits for each PCM or DLC card that has been programmed to accept tone digits. Each card has a set of 8 LED indicators. Each LED represents a receiver and will light when it's receiver is attached to the line. The LED will go out when the receiver is released.

The Tone Receiver card may be set to decode MF or TT digits and contains one DIP switch, SW1. SW1 selections indicate from 1 to 7 card slot numbers.

The Tone Receiver card DIP switch must be set to the card's location. The Tone Receiver cards must be installed from right to left, starting with Slot 10.

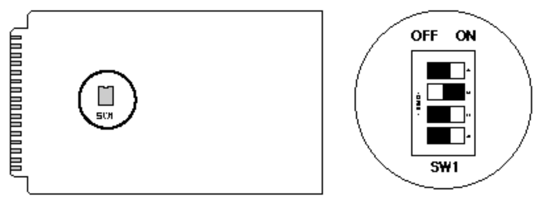


Figure 1-20. Tone Receiver Card DIP Switch

Table 1-11. Tone Receiver Card SW1 Settings

DIP Switch Settings			PCM Card Slot	Install Order
1	2	3		
On	Off	Off	Slot 4	7 th
Off	On	Off	Slot 5	6 th
On	On	Off	Slot 6	5 th
Off	Off	On	Slot 7	4 th
On	Off	On	Slot 8	3 rd
Off	On	On	Slot 9	2 nd
On	On	On	Slot 10	1 st

1.4 Accessories

1.4.1 Transit Case

A transit case is available for secure commercial transportation of one or two units, complete with cables and instruction manuals.

1.4.2 Rack Mounting Kit

The AM7 can be rack mounted in standard 19" racks with an optional rack mount kit.

1.4.3 Spare Card Carrying Case

Used to store up to 20 line card modules.

2. GETTING STARTED

The Getting Started section is presented to set up the AM7 for operation and verify its proper operation. It begins with unpacking the unit, applying power, and performing some of the AM7's basic operations.

2.1 Unpacking

Each AM7 is thoroughly tested and carefully packaged before shipment. Upon receipt, inspect the outside of the shipping container for any damage. If damage is noted, immediately contact the carrier. The name of the carrier will be noted on the packing slip which is attached to the outside of the shipping container.

Note: Preserve the shipping container and packing materials in the event that the unit may be shipped or returned in the future.

Open the shipping container and compare the contents with the packing slip. Note any damage or shortages. Notify the carrier in the event of damage. Notify Ameritec in the event of a shortage.

2.2 Power

The AM7 is configured with either a 115VAC or 220VAC 50/60Hz power supply. A power cord is supplied with each unit.

Connect the AM7 to a clean and stable source of the indicated voltage. Pull the power switch out and set it upward to the On position. A green LED (ON) lights to verify that power is on. Pull and set the switch downward to turn power off.

Note: The AM7 provides approximately 30 days of memory backup. If power is removed for a longer amount of time, all the parameters that have been set up will return to factory default settings.

When power is applied to the AM7, the Parameter/Data Display shows the default clock setting. A 24-hour clock is used. An entry of 2:00 pm on April 24, 1997, is made by entering 1400 042497. Once the data has been typed in, press the ETR🡣 key. The clock and calendar data is now programmed into memory.

2.3 Basic Operation

Several operations must be performed after the AM7 is received (with cards already in slots with proper DIP switch settings) in order to prepare it for operation.

Apply Power.

Enter System Parameters. Proper operation requires the entry of data into the AM7 to direct it to perform required test tasking. System parameters are data entered into the AM7 to tell it what form the information it receives will take, and what to do with the information once it has been received. The AM7 has a number of parameters unique to the overall system. Each parameter has a factory-set default value that may be changed via the Program Keyboard or a Remote keyboard.

Enter Line Parameters. In addition to the System parameters, the AM7 offers a wide variety of Line Setup parameters that may be programmed to match specific testing requirements. Each line can be individually programmed, or all lines can be programmed with identical requirements. Each parameter has a factory-set default value that may be changed via the Program Keyboard or a Remote keyboard.

Enter Dialing Code. Dialing Codes are analogous to numbering plans established and programmed within a digital central office. They are broken down into 4 groups of 8 expected digits fields containing a string of digits that must be matched in order to activate an Action Code sequence. When an expected digit field (dialing code) is matched, from 1 to 8 actions associated with that specific dialing code are performed.

Enter Action Codes. Action Codes contain the instructions to be performed by the AM7. Each Dialing Code (expected digit set) can contain up to 8 Action Codes (instructions) to be performed.

2.3.1 Loop/Ground Start Card Operation

The AM7's ability to detect and decode incoming dialing sequences and switch calls to the programmed output is demonstrated by connecting two standard analog telephones to an AM7 interface Loop/Ground Start port card for Line 1 and 2 in slot 1. The AM7 is shipped from Ameritec with a factory default dialing code expected digit program of 99999--. When the number 99999 followed by an installed line's number (01 - 20) is dialed, either DTMF or Dial Pulse, the AM7 responds by applying ringing to the line number dialed, and ringback to the incoming line. If a mixture of PCM/DLC and analog cards are installed, card slot 1 will not be available for this operation. In this case, simply select the first available Loop/Ground Start card and substitute the "01" and "02" after the 99999 with the appropriate port numbers. This provides a quick check of the operation of the AM7 without the need for any initial programming.

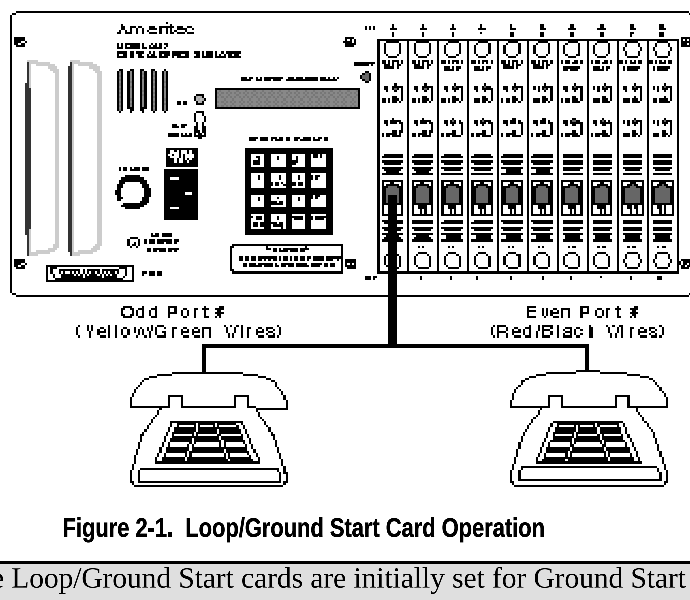


Figure 2-1. Loop/Ground Start Card Operation

Note:	The Loop/Ground Start cards are initially set for Ground Start operation. To perform this operation, first set the SW2 Dip switch on the line card for Loop Start. See Table 1-5 for instructions.

2.3.2 PCM Card Operation

If the AM7 is equipped with PCM linecards, follow the procedures outlined below to get familiar with the unit. This exercise assumes that a channel bank connected to the AM7's T1 port(s) is being used. If this is not the case, make the following adaptation. Connect a channel bank's T1 span line to PCM card number 1 in slot 1 of the AM7. Connect an analog telephone to one of the Loop Start ports of the channel bank.

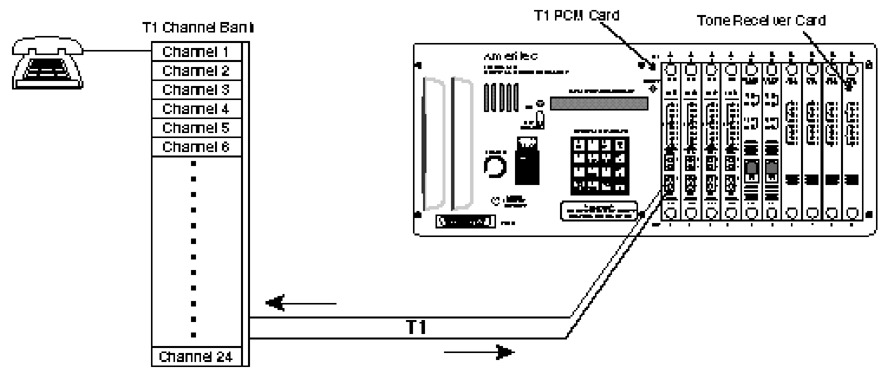


Figure 2-2. PCM Card Operation

The AM7 with PCM cards is defaulted to emulate E&M signaling with Wink Start dialing. It is also set to supply the 8kHz clock signal. The Tone Receivers, if installed, are defaulted to accept MF dialing. The PCM channels are defaulted to expect only dial pulse digits.

When a PCM card is being used, the Start Mode display appears only if E&M (3) has been selected in the Emulation display. Four selections may be made for the Start Mode: Immediate (1), Delay (2), the factory default Wink (3), or Dial Tone (4). For this exercise, the Start Mode should be changed from Wink (3) to Dial Tone (4). To do this, select the span and channel number where you expect to see the activity generated by the phone connected to the channel bank. For example, if the activity is to take place on channel 1 of Span 1, select 101 in the display by keying SEL, 101, ETR🡻. Continue to press ETR🡻 until you reach the START MODE parameter. Press the 4 key. The flashing 3 will now read 4. Press ETR🡻 once again to enter this change.

Continue to press ETR↓ until you reach TD=1 DP=2 AL=3 with a flashing 2. If at least one Tone Receiver card is installed, press 3 followed by ETR↓. You will then be presented with the display TT=1 MF=2 with a flashing 2. Press 1 followed by ETR↓. This will tell the channel to expect either dial pulse or DTMF digits. If no Tone Receiver cards are installed, you must leave the previous selection set to 2 (DP), and the digits received from the phone must be Dial Pulse, not DTMF.

If Tone Receiver cards are installed, they must be set to expect DTMF (TT) digits. To do this, select the unit parameters by keying SEL, 000, ETR↓. Continue pressing ETR↓ until you reach the parameter, REC10 1=T 2=M, with 22 being the current setting. Press 1 followed by ETR↓. This sets group A of the Tone Receiver card in slot 10 for DTMF.

Now select channel 101 by keying SEL, 101 (or the channel being used by the telephone), ETR↓. The upper eight red LED's on the PCM card will indicate the status of the ABCD bits, with the top four LED's representing the Send bits and the lower four LED's representing the Receive bits. If they are scrolling, it means that there is a loss of synchronization between the channel bank and the AM7. Be sure to verify proper connection if this is the case.

Go off hook on the telephone connected to the analog side of the channel bank. You will see the data LED's change state to reflect the seizure.

When you hear the dial tone at the phone, dial 9999902. You will hear ringback at the telephone and channel 2 of the PCM span will assume a ringing bit state. If you have a second phone connected to the analog equivalent of time slot 2 of the channel bank, the phone would now be ringing.

This all took place because the Dialing Codes default to expect 99999 plus two other digits. These last two digits direct the call to that channel number of the same span. Any other channel of any other span installed in the AM7, or any other analog line installed in the AM7 can be dialed. See section 3.5.1, Dialing Code Programming, for definitions for this area.

2.3.3 DLC Card Test

If the AM7 is equipped with DLC linecards, follow the procedures below to get familiar with the unit. This exercise assumes that a SLC®96 remote terminal is connected to the AM7's DLC ports. Connect the remote terminal's T1 span line to DLC card number 1 in slot 1 of the AM7, and connect an analog telephone to one of the analog loop start ports of the remote terminal.

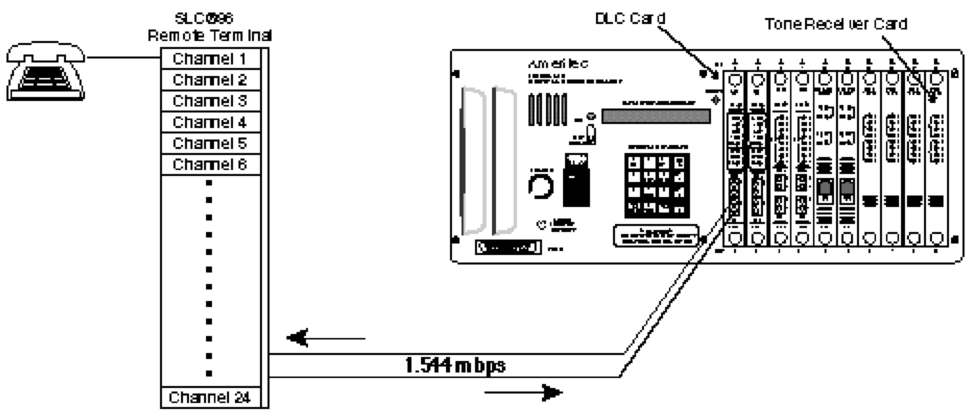


Figure 2-3. DLC Card Test

The AM7 with DLC cards is defaulted to emulate Mode I operation. It is also set to supply the 8kHz clock signal. The channels are defaulted to expect only Dial Pulse digits.

Select channel 1 of span 1 by keying SEL, 101, ETR↓. Continue to press ETR↓ until you reach TD=1 DP=2 AL=3 with a flashing 2. If at least one Tone Receiver card is installed, press 3, followed by ETR↓. If no Tone Receiver cards are installed, you must leave the previous selection set to 2 (DP) and the digits received from the phone must be Dial Pulse, not DTMF.

If Tone Receiver cards are installed, they must be set to expect DTMF (TT) digits. To do this, select the unit parameters by keying SEL, 000, ETR↓. Continue pressing ETR↓ until you reach the parameter, REC10 1=T 2=M, with 22 being the current setting. Press 1 followed by ETR↓. This sets group A of the Tone Receiver card in slot 10 for DTMF.

Now select channel 101 by keying SEL, 101 (or the channel being used by the telephone), ETR↓. The upper four red LED's on the DLC card will indicate the status of the AB bits, with the top two LED's representing the Send bits and the lower two LED's representing the Receive bits. If they are scrolling, it means that there is a loss of synchronization between the remote terminal and the AM7. Be sure to verify proper connection if this is the case.

Go off hook on the telephone connected to the analog side of the remote terminal. You will see the red LED's change state to reflect the seizure.

When you hear the dial tone at the phone, dial 9999902. You will hear ringback at the telephone and channel 2 of the DLC span will assume a ringing bit state. If you have a second phone connected to the analog equivalent of channel 2 of the remote terminal, the phone would now be ringing.

This all took place because the Dialing Codes default to expect 99999 plus two other digits. These last two digits direct the call to that channel number of the same span. Any other channel of any other span installed in the AM7, or any other analog line installed in the AM7 can be dialed. See section 3.5.1, Dialing Code Programming, for definitions for this area.

3. SYSTEM SETUP AND PROGRAMMING

Proper operation requires the entry of data into the AM7 to direct it to perform required test tasking. System parameters are data entered into the AM7 to tell it what forms the information it receives will take, and what to do with the information once it has been received.

3.1 System Parameters

The AM7 has a number of parameters unique to the overall system. Each parameter has a factory set default value that may be changed when you are setting up the system. The AM7 system parameters are illustrated and described below in the order in which they appear on the Parameter/Data Display (display).

> **Note:** If an attempt is made to enter improper data into a parameter field, pressing any of the ETR keys will cause the display to blink. Proper data may then be entered by pressing a numeric key or the SHIFT key.

3.1.1 Clock/Calendar

`CLOC 0000 000000`

When power is turned on to the AM7, the display shows the default time, month, date, and year. A 24-hour clock is used. An entry of 2:00 pm on April 24, 1997, is made by pressing the following Program Keyboard (keypad) keys: 1400 042497. Once the data has been keyed in, press the ETR↓ key. The clock and calendar data is programmed into memory, and the next system parameter value appears. To display or change the clock after the system is running, press SEL 000, then ETR↓ to access the system parameters.

3.1.2 Automatic Printout

`AUTO PRT NO=0  1`

The AM7 is capable of automatically generating hourly printouts of call statistics via the RS232C port. The factory default is YES. To select NO, type in 0 and press the ETR↓ key (enter a "0").

3.1.3 Dial Tone Select

`DT CON=1 INT=2 1`

A dial tone is a dual-tone waveform that the AM7 uses as a Start Dial signal to let you know that it is operating and ready to receive the number that you dial. The AM7 can generate more than one type of dial tone. The factory default is "1" for a continuous dial tone. An interrupted dial tone (ON/OFF cadence) may be selected by entering a "2". If an interrupted dial tone is selected, two displays become available that allow you to control the duration (from 0000 to 9900 milliseconds in 100ms steps) of the two-phase dial tone. The AM7 default

`DT 1  0600: 1000`　`DT 2  0200: 0200`

settings place the first part of the dial tone ON for 600ms and OFF for 1000ms; the second part ON for 200ms and OFF for 200ms, after which the cadence repeats.

3.1.4 Dial Tone Level and Frequency

The dial tone's default Levels (dBm) and Frequencies (Hz) of tone A and B of the dual-tone waveform (displayed below) are set for a standard USA dial tone. The Level (power of the signal) is negative, and may be set by entering values from

`DT L-F A 13-0350`　`DT L-F B 13-0440`

-03dBm to -39dBm. Frequencies (cycles of current in 1 second) may be set by entering values from 0200Hz to 3500Hz. In order to generate a single tone, set the A values to the desired level and frequency, and the Level of B to "99". A Level of "99" disables a tone. Results may be unpredictable if A and B are set to the same Frequency.

3.1.5 Ringing Frequency

`RING FRE     200`

The default frequency of the AM7's ringing cadence (20.0Hz) can be changed by entering values from 15Hz to 35Hz in 0.1Hz increments in order to simulate various systems. Remember that a decimal point does not appear on the display.

3.1.6 Ringing Sequences

The AM7 provides a user-selected ringing cadence by means of two ringing sequences (Ring 1 and Ring 2). These ringing sequences can be used to simulate switch or central office ringing to provide an accurate simulation of a test environment. Ring 1 defaults to an ON time of 2000ms and an OFF time of

RING 1 2000-4000	RING 2 0000-0000

4000ms. Ring 1 time can be programmed by entering values from 0100ms to 9900ms in 100ms increments. If Ring 2 is programmed for any other values than the default times of 0000ms ON time and 0000ms OFF time, it provides its ringing cadence after Ring 1. Ring 2 time can be programmed by entering values from 0000ms to 9900ms in 100ms increments.

If, for example, a ring of 2 seconds ON, 4 seconds OFF, 2 seconds ON, 1 second OFF is required; Ring 1 is programmed for 2000ms/4000ms, and Ring 2 is programmed for 2000ms/1000ms.

3.1.7 Ringback Sequences

A ringback is a single or dual-tone waveform that the AM7 uses to advise the caller that ringing voltage is being sent to the called party. The AM7 provides a user-selected ringback cadence by means of two ringback sequences (Ringback 1 and Ringback 2). These ringback sequences can be used to simulate switch or central office types to provide an accurate simulation of a test environment. Ringback 1 defaults to an ON time of 2000ms and an OFF time of 4000ms.

RB 1 2000-4000	RB 2 0000-0000

Ringback 1 time can be programmed by entering values from 0100ms to 9900ms in 100ms increments. If Ringback 2 is programmed for any other values than the default times of 0000ms ON time and 0000ms OFF time, it provides its ringback cadence after Ringback 1. Ringback 2 time can be programmed by entering values from 0000ms to 9900ms in 100ms increments.

If, for example, a ringback of 2 seconds ON, 4 seconds OFF, 2 seconds ON, 1 second OFF is required; Ringback 1 is programmed for 2000ms/4000ms, and Ringback 2 is programmed for 2000ms/1000ms.

3.1.8 Ringback Level and Frequency

The ringback's default Levels (dBm) and Frequencies (Hz) of tone A and B (displayed below) are set for a standard USA ringback. The Level is negative,

`RB L-F A 19-0440` `RB L-F B 19-0480`

and may be set by entering values from -03dBm to -39dBm. Frequencies may be set by entering values from 0200Hz to 3500Hz. In order to generate a single tone, set the A values to the desired level and frequency, and the Level of B to "99". A Level of "99" disables a tone. Results may be unpredictable if A and B are set to the same Frequency.

3.1.9 Line Busy Sequences

Line busy is a dual-tone waveform that the AM7 uses to advise the caller that the called party is off-hook. The AM7 provides a user-selected line busy cadence by means of two line busy sequences (Line Busy 1 and Line Busy 2). These line busy sequences can be used to simulate switch or central office types to provide an accurate simulation of a test environment. Line Busy 1 defaults to an ON time of 0500ms and an OFF time of 0500ms, and can be programmed by entering

`LB 1   0500-0500` `LB 2   0000-0000`

values from 0100ms to 9900ms in 100ms increments. If Line Busy 2 is programmed for any other values than the default times of 0000ms ON time and 0000ms OFF time, it provides its line busy cadence after Line Busy 1. Line Busy 2 time can be programmed by entering values from 0000ms to 9900ms in 100ms increments.

If, for example, a line busy of 1/2 second ON, 1/2 second OFF, 1/2 second ON, 1 second OFF is required; Line Busy 1 is programmed for 500ms/500ms, and Line Busy 2 is programmed for 500ms/1000ms.

3.1.10 Line Busy Level and Frequency

The Line Busy default Levels (dBm) and Frequencies (Hz) of tone A and B (displayed below) are set for a standard USA line busy. The Level is negative, and may be set by entering values from -03dBm to -39dBm. Frequencies may be

LB L-F A 24-0480	LB L-F B 24-0620

set by entering values from 0200Hz to 3500Hz. In order to generate a single tone, set the A values to the desired level and frequency, and the Level of B to "99". A Level of "99" disables a tone. Results may be unpredictable if A and B are set to the same Frequency.

3.1.11 Reorder Sequences

Reorder is a dual-tone waveform that the AM7 uses to advise the caller that all possible call paths through the AM7 are busy at the time of the call attempt. The AM7 provides a user-selected reorder cadence by means of two Reorder sequences (Reorder 1 and Reorder 2). These reorder sequences can be used to simulate switch or central office types to provide an accurate simulation of a test environment. Reorder 1 defaults to an ON time of 0200ms and an OFF time of

RO 1 0200-0300	RO 2 0000-0000

0300ms, and can be programmed by entering values from 0100ms to 9900ms in 100ms increments. If Reorder 2 is programmed for any other values than the default times of 0000ms ON time and 0000ms OFF time, it provides its reorder cadence after Reorder 1. Reorder 2 time can be programmed by entering values from 0000ms to 9900ms in 100ms increments.

If, for example, a reorder of 2/10 second ON, 3/10 second OFF, 2/10 second ON, 1 second OFF is required; Reorder 1 is programmed for 200ms/300ms, and Reorder 2 is programmed for 200ms/1000ms.

3.1.12 Reorder Level and Frequency

The Reorder default Levels (dBm) and Frequencies (Hz) of tone A and B (displayed below) are set for a standard USA reorder. The Level is negative, and

`RO L-F A 24-0480` `RO L-F B 24-0620`

may be set by entering values from -03dBm to -39dBm. Frequencies may be set by entering values from 0200Hz to 3500Hz. In order to generate a single tone, set the A values to the desired level and frequency, and the Level of B to "99". A Level of "99" disables a tone. Results may be unpredictable if A and B are set to the same Frequency.

3.1.13 Tone Dialing Analyzer Report

The Tone Dialing Analyzer gives the AM7 the capability of analyzing the level, frequency, twist, and digit timing of the two tones that make up a tone dialed digit. Thresholds may be programmed for each parameter, and used for the generation of a Tone Dialing Report. A Tone Dialing Report is generated by entering a "1" when the "TD RPT" display appears. Any measured parameter that falls outside the programmed thresholds is flagged by an asterisk in the Tone Dialing Report. See Section 3.3 for further information.

`TD RPT Y=1 N=0 1`

```
TT DIAL REPORT 14:32 05/14/97
LINE 04 - ALL DIGITS
      LOW-BAND              HIGH-BAND         TWST  OFF    ON
   FREQ   DEV LEVEL    FREQ  DEV  LEVEL             TIME  TIME
   (HZ)   (%) (dBm)    (Hz)  (%)  (dBm)       (dB)  (mS)  (mS)
5  0766  -0.5  -07     1332  -0.3  -05*       +02   2220  0339
6  0766  -0.5  -07     1472  -0.3  -06        +01   0253  0291
4  0766  -0.5  -08     1216  +0.6  -06        +02   0242  0343
3  0699  +0.3  -08     1472  -0.3  -06        +02   0386  0194
1  0699  +0.3  -08     1216  +0.6  -06        +02   0175  0203
*  0850  -0.2  -18     ----   ---  ---        ---   1381  0017
!  ----  ---   -36*    ----   ---  ---        ---   0039  0003
```

Parameter analysis is made on either a single line, or randomly on all lines. The report may be set up to print only abnormal parameters and is sent, real time, out the RS-232 port. When the Tone Dialing Report is selected, the following thresholds can be programmed.

3.1.13.1 Low Tone Level

Each number generated by tone dialing, DTMF or MF, is made up of two frequencies generated at the same time. The low (LO) and high (HI) frequency each has a specific power level (measured in dBm). Factory defaults for the low tone are -18 dBm minimum and -06 dBm maximum. A range of low tone values from 00 dBm to -40 dBm may be entered, in 1 dBm increments.

```
TD LO     -18 -06
```

3.1.13.2 High Tone Level

Factory defaults for the high tone are -18 dBm minimum and -06 dBm maximum. A range of high tone values from 00 dBm to -40 dBm may be entered, in 1 dBm increments.

```
TD HI     -18 -06
```

3.1.13.3 Twist Level

The difference in dBm level between the high and low frequency of the tone pairs is called "twist". The Twist value is arrived at by subtracting the low frequency level from the high frequency level. Factory defaults are a maximum negative twist of -6 dBm and a maximum positive twist of +6 dBm. A range of twist values from -12 dBm to +12 dBm may be entered, in 1 dBm increments.

```
TD TWIST  -06 06
```

3.1.13.4 Frequency Offset

The frequency offset parameter specifies the maximum frequency difference that is to be allowed between received tones and the expected tones. The factory default allows for a 1.5% variance in the expected frequency. A range of frequency offset values from 0.0 to 3.5% may be entered, in .1% increments.

```
TD FRE          15
```

3.1.13.5 Tone ON/OFF Time

OFF Time is the duration of a quiet interval preceding a tone. ON Time is the duration of the tone. The low limit for the tone pair ON and OFF times is set by this parameter. The factory default calls for ON and OFF times of 35ms.

`TD ON-OFF  35-35`

A range of ON/OFF times from 20ms to 99ms may be entered, in 1ms increments.

3.1.13.6 Tone Guard Time

Tones that are ON for the same amount of time or longer than the Tone Guard Time are reported in the Tone Dialing Report; those with a shorter ON time do not appear. The time is added to the OFF Time of the next reported tone. This simplifies troubleshooting in cases where a fault in a Tone Dialer causes many many spurious tones. Increasing the Tone Guard Time filters such tones out

`TD GUARD      20`

of the report, making it easier to interpret. When it is necessary to analyze spurious tones, Tone Guard Time is reduced in order to view them. The factory default is 20ms. A range of Tone Guard Times from 0ms to 99ms may be entered, in 1ms increments.

3.1.13.7 Tone Dial Line Analysis

Select the factory default Random Tone Dialing Analysis to randomly select lines to analyze in the AM7. In random mode (R=1), each time a line that the

`TD  R=1 F=2    2`

analyzer is connected to becomes idle, it is reassigned to the next line that becomes busy. In order to analyze a particular line, select the Fixed Line mode (F=2), then select the line to be analyzed (Line 15 for example).

`TD LINE      015`

3.1.13.8 Tone Dial All Digits Analysis

TD ALL Y=1 N=0 1

When "1" is entered, the Tone Dialing Report includes all digits or events analyzed. When "0" is entered, the report includes only digits or events whose parameters are outside their programmed range.

3.1.14 Dial Pulse Report

DP RPT Y=1 N=0 1

The AM7 analyzes each decoded dial pulse digit for its speed, percent break, and minimum interdigit time. Thresholds may be programmed for each parameter, and used for the generation of a Dial Pulse Report. A Dial Pulse Report is generated by entering "1" when the "DP RPT" display appears.

Any measured parameter that falls outside the programmed thresholds is flagged by an asterisk in the Dial Pulse Report. The report may be set up to print only abnormal parameters and is sent, real time, out the RS232 port. Parameter analysis is made on either a single line, or randomly on all lines. When the Dial Pulse Report is selected, the following thresholds can be programmed.

3.1.14.1 Pulse Speed

DP SPEED 08-12

Dial Pulse speed is the number of pulses a rotary dial can send in a given period of time, typically 10 per second. A modem with a communications package can send 20 pulses per second (pps). The factory default for the speed of the dial pulse is from 08pps to 12pps. A range of Dial Pulse Speed from 05pps to 30pps may be entered, in 1pps increments.

3.1.14.2 Pulse Break

DP BREAC 50-70

A Dial Pulse is generated by a closed (break), then open period of current flow. The factory default for an acceptable amount of break in the duration of a dial pulse is from 50% to 70% of the pulse. A range of dial pulse break from 20% to 80% may be entered, in 1% increments.

3.1.14.3 Pulse Interdigit Time

`DP ID TIME   400`

The factory default for the minimum amount of time between the digits of dial pulse signals is 400ms. A range of interdigit time from 200ms to 995ms may be entered, in 5ms increments.

3.1.14.4 Dial Pulse Line Analysis

`DP  R=1 F=2    2`

Select the factory default Random Pulse Dialing Analysis to randomly select lines in the AM7. In random mode (R=1), each time a line that the analyzer is connected to becomes idle, it is reassigned to the next line that becomes busy.

`DP LINE       015`

In order to analyze a particular line, select the Fixed Line mode (F=2), then select the line to be analyzed (Line 15 for example).

3.1.14.5 Dial Pulse All Digits Analysis

`DP ALL Y=1 N=0 1`

When "1" is entered, the Dial Pulse Report includes all digits analyzed, along with their speed, percent break, and interdigit time. When "0" is entered, the report includes only digit parameters outside their programmed range.

3.1.15 Connection Loss

`CONN LOSS     06`

The amount of connection loss (in dB) from the incoming line to the outgoing line through the AM7 can be simulated. The factory default is 6dB. A range of connection loss from 0dB to 14dB may be entered, in 1 dB increments.

3.1.16 Master Span

`MASTER SPAN    0`

The AM7 has an 8kHz internal clock source. The clock source may also be taken from the line connected to a PCM or DLC line card located in card slots 1 thru 4 in the AM7, by entering that card's slot number (1 - 4). An entry of zero is the default entry for using the AM7 internal clock.

3.1.17 Receiver Card Signaling Type

`REC10 1=T 2=M 22`

The receiver type must be selected for each of the two receiver groups on a Tone Receiver card. The first digit represents Group A, while the second digit represents Group B. Enter a "1" for a Touch Tone (DTMF) receiver group of 3 receivers, or a "2" for a Multi-Frequency (MF) receiver group of 4 receivers. The default setting is "22", setting both groups of receivers to decode MF. The number immediately following "REC" indicates the slot (4-10) in which the Tone Receiver card is installed. A separate display will appear for each installed Tone Receiver card.

3.1.18 RS232C Port Configuration

The Baud Rate and Parity must be selected to match a device if it is connected to

`BAUD 0300`   `PARITY ODD=1 0`

the RS232C connector on the AM7. The factory default for an external device Baud Rate is 300 Bps. 1200, 2400, 4800, and 9600 Bps Baud Rates are also available for selection. Either EVEN (the factory default) or ODD parity may be selected.

3.1.19 Software Version

`VERSION _22`

The version display allows the version of software installed in the AM7 to be confirmed. This is a display-only parameter and cannot be changed.

3.2 Line Parameters

In addition to the System parameters, the AM7 offers a wide variety of Line Setup parameters that may be programmed to match your specific testing requirements. Each line can be individually programmed, or all lines can be programmed with identical parameters.

Normally the System Setup parameters are entered first, followed by the Line Setup. If the System Setup is satisfactory, press the SEL key on the keypad. When the SELECT display appears, enter the 3-digit line number to be programmed.

`SELECT 001`

3.2.1 Analog Card Line Parameters

Analog Line parameters are entered for lines 001 thru 020. If the selected line is 000, the AM7 will return to the clock/calendar display. An unacceptable entry will cause the display to blink. Each of the following AM7 Line parameters are described in the order of their displayed appearance.

3.2.1.1 Dial Tone Delay

`START DELAY 00`

The Dial Tone Delay allows changes to be made in the amount of time it takes for a device dialing in to the AM7 to receive a dial tone after it is detected as being off hook. The default time is 0 seconds. A range of Dial Tone Delay time from 0 to 99 seconds may be entered, in 1 second increments. A delay of greater than 0 may be entered to simulate heavy calling volume being placed on the system.

3.2.1.2 Auto Code

`AUTOCODE YES=1 0`

The Auto Code entry causes a line to have an automatic Dialing Code match with Dialing Code 8 of its assigned Code Group whenever it goes off hook. The action designated by that Dialing Code is then executed. Dialing Code actions are described in detail later in this manual.

The Auto Code feature allows a sequence of actions to be performed at off hook time, even though no digits have been dialed. The factory default is 0 for NO.

Since the purpose of Auto Code is to have an automatic dialing code match at off-hook without the need of incoming digits, there is generally no need to use a tone receiver. With Auto Code, the dialing code match will be made regardless of the presence or absence of incoming digits.

With Analog interfaces, the on-board tone receiver is permanently attached even when it is not being used; as is generally the case when Auto Code is enabled.

3.2.1.3 Confirming Tone

At any time in a test sequence, the AM7 can be programmed to generate one of a group of available frequencies. This "Step Sequence", or group of confirming tones, is commonly used to indicate the completion of a programmed function. Step Sequences are discussed in detail in the section on Dialing Codes.

```
CONF TONE       0
```

Thirteen different tones can be entered that will respond to the "send confirming tone" step sequence command.

Table 3-1. Confirming "Step Sequence" Tones

Code	Freq. (Hz)	Code	Freq. (Hz)	Code	Freq. (Hz)
0	1010 (Test Tone)	1	1150	2	1275
3	1400	4	1525	5	1650
6	1775	7	1900	8	2025 Modem Answerback Tone
9	2150	A	2275		
B	2400	C	900		

3.2.1.4 Hunt Group

The AM7 can set up calls to be connected from an incoming port to a group of outgoing ports called a Hunt Group. A Hunt Group is a series of telephone lines organized in such a way that if the first line is busy, the second line is tried, and so on until a free line is found. Any number of lines can be designated to be part of from 1 to 8 Hunt Groups. The default hunt group is Hunt Group 1. In other words, a fully configured system would have all 20 lines programmed into Hunt Group 1. To have two equal Hunt Groups, lines 1-10 could be assigned to Hunt Group 1, and lines 11-20 assigned to Hunt Group 2. If a call is directed into a hunt group (by means of an Action Code) that does not exist, a Reorder Tone is generated.

```
HUNT GROUP      1
```

3.2.1.5 Answer Supervision

When a called party responds with an Off-Hook condition, the called party's Central Office sends an Answer Supervision signal to the calling party's Central Office. Answer Supervision monitors AM7 lines to ensure that the called party responded with an Off-Hook condition. The default, SUPU Y=1, indicates that all loop or ground start calls switched through the AM7 will see a battery/ground reversal (Answer Supervision) signal returned to the incoming port.

```
SUPU Y=1 N=0    1
```

3.2.1.6 Dialing Code Group

Dialing codes and step sequences, described in detail later in this manual, are similar to the numbering plans used by a digital central office. The sequence of digits allowed, and the steps to perform when those digits are decoded, can be established for the AM7. Dialing codes are contained in Group A thru Group D. Each group contains eight dialing codes of from 1 to 12 expected digits. When a line assigned to a given group matches expected digits, the step sequence associated with those digits is performed. Each dialing code can execute only one step sequence per call. Each line can be assigned to any of the four groups.

```
CODE GROUP      A
```

3.2.1.7 Dialing Code Report

`DC RPT Y=1 N=0 1`

When a call across a line assigned to a dialing code group fails to match any expected digits, or extra digits are received after a match is made, a Dialing Code Error report can be generated. The Dial Code Report default is YES, and prints the digits that were received in error and not decoded. See Section 5.1.5 for further information.

3.2.1.8 Call Progress Tones

`TON NOR=1 LO=0 1`

Call Progress Tones are sent from a standard telephone company central office to tell the caller the progress of the call and are simulated by the AM7. The tones are Dial Tone, Ringback, Line Busy, and Reorder, and can be placed in either a NORMAL or LOW setting.

Table 3-2. Call Progress Tone Levels

Call Progress Tone	Frequency	Normal Level	Low Level
Dial Tone	350 + 440 Hz	-10dBm	-30dBm
Ringback	440 + 480 Hz	-16dBm	-35dBm
Line Busy	480 + 620 Hz	-21dBm	-35dBm
Reorder	480 + 620 Hz	-21dBm	-35dBm

3.2.1.9 Tone Dial (DTMF) and Dial Pulse Decode

`TD=1 DP=2 AL=3 3`

Individual AM7 lines can be set up to accept and decode Tone Dial (TD) digits, Dial Pulse (DP) digits, or both (AL). The Tone Dial (DTMF) and Dial Pulse Decode default is Dial Pulse (DP=2).

3.2.1.10 Flash Time

The Flash Hook is the receiver button that hangs up the phone. If the button is pushed quickly, it can signal the Central Office to perform an action, such as place a call on hold, switch to an incoming call (call waiting), or transfer a call. The factory default set for the minimum amount of time that an incoming line's On Hook state is acknowledged as a Hook Flash is 450ms. A minimum Flash Time of from 50ms to 1245ms may be entered, in 5ms increments. Flash Time may not be entered with a value greater than or equal to Disconnect Time, or the Flash Hook signal will no be recognized before the phone connection is shut down.

`FLASH TIME  0450`

3.2.1.11 Disconnect Time

If the receiver button is placed in an On Hook state for a sufficient period of time, the AM7 recognizes that the phone connection has been shut down. The factory default set for the minimum amount of time that each line's On Hook time will be recognized as a disconnect is 1000ms. A minimum Disconnect Time of from 200ms to 1250ms may be entered, in 5ms increments. Disconnect Time must be entered with a value greater than the Flash Time in order for a Flash Hook signal to be recognized.

`DISC TIME   1000`

3.2.1.12 Wink Time

A Wink is a momentary interruption, indicating that a Central Office is ready to receive the digits that have just been dialed. It is a single supervisory pulse, signaled by a change in polarity on the line.

The Wink Time is the period of time that the (battery/ground reversal) supervision signal remains on the line. The factory default is 250ms. A Wink Time of from 50ms to 950ms may be entered, in 5ms increments.

`WINC TIME    250`

3.2.1.13 Call Activity Registers

While the AM7 is operating, it generates a realtime statistical peg count in a set of Call Activity Registers. There are 10 Call Activity Registers per line, one register to keep track of the call attempts made (ATTEMPTS), one register for each of eight possible Dialing Codes (CODE 1-8), and one register for numbers that don't match a Dialing Code's expected digits (NO CODE).

Each register is updated continuously (to a maximum of 65,535) and can be observed by selecting its line and pressing the ETR🡻 key until the register appears. To view the same register in all lines, locate the register and press the ETR➔ key to step sequentially through each line.

The contents of a line's register or all line registers can be printed by using the SPCL (secondary function) key on the keypad. See Section 5, Reports, for further information.

The Call Attempts Register increments each time the AM7 detects an incoming Off Hook condition on the line. Each time a line's incoming dialing code matches a Dialing Code's expected digits, its Code Register is incremented by one. If a call attempt occurs without a dialing code match, the No Code Register increments by one. Typically, when one match per call is detected, the Call Attempts Register equals the sum of the other 9 registers. However, if single calls create multiple code matches, the Call Attempts Register contains less than the other 9 registers.

```
ATTEMPTS   00000
CODE 1     00000
NO CODE   _00000
```

3.2.2 PCM (T1) Card Line Parameters

PCM line parameters are entered for the 24 channels of each Span (101-124, 201-224, 301-324, 401-424). PCM Card Span Data Registers can be viewed by entering the PCM card slot location via the SEL display (100, 200, 300, or 400). The following Span Data Registers can be viewed by repeatedly pressing Enter:

- MF OFL - Occurs when no Multi-Frequency tone receiver was available when first requested.
- TT OFL - Occurs when no Touch Tone tone receiver was available when first requested.
- BPV - Bipolar is the predominant signaling method used for T1 lines. The signal carrying the binary value alternates between positive and negative (1 and 0). A Bipolar Violation is the presence of two consecutive "one" bits of the same polarity on a T1 line.
- SLIP - A SLIP is the condition under which a receiver of a digital signal experiences starvation or overflow in its receive buffer due to a small difference in the speeds of clocks and the clock (transmission rate) at the transmitter. The receiver will drop or repeat a full TDM frame (193 bits on a T1 line) in order to maintain synchronization.
- FERR - A Frame is a group of data bits in a specific format, usually containing its own control information for addressing and error checking, with a flag at each end to indicate the frame's beginning and end. The PCM card uses an ESF (Extended Super Frame) or D4 format. In the 12 bit, D4 frame word, an error is counted when the 12-bit frame word received does not conform to the standard 12-bit frame word pattern.
- CRC ERR - A Cyclical Redundancy Check is a process used to check the integrity of a block of data. A CRC character is generated at the end of the transmission. Its value is the hexadecimal value of the number of "ones" in the data block. The receiving end makes the same calculations and compares it to the transmitted value. If the calculations do not match, a CRC Error is generated.

Table 3-3. PCM Card Span Data Registers

Data Register	Display
MF OFL - The number of Multi Frequency receiver (decoder) overflows.	MF OFL 00000
TT OFL - The number of Touch Tone receiver (decoder) overflows.	TT OFL 00000
BPV - The number of Bipolar Violations for the selected Span.	BPU 00000
SLIP - The number of Frame Slips for the selected Span.	SLIP 00000
FERR - The number of Framing Errors for the selected Span.	FERR 00000
CRC ERR - The number of CRC (Cyclical Redundancy Check) Errors for the selected Span.	CRC ERR 00000

Each of the following T1 line parameters are described in the order of their displayed appearance.

3.2.2.1 Emulation

`EMULATION 3`

When a PCM card is being used, each of the 24 PCM line channels can emulate (pretend to be) a Ground Start, Loop Start or E&M line interface. The factory default setting of 3 emulates an E&M interface.

3.2.2.2 Start Mode

The start signal is generated by the AM7 in response to an incoming line seizure It signals that the AM7 has attached a receiver and is ready to receive digits.

`START MODE 3`

When a PCM card is being used, the Start Mode display appears only if E&M (3) has been selected in the Emulation display.

Four selections may be made for the Start Mode:

(1) Immediate - An Immediate Start indicates that the AM7 is immediately ready to receive digits when an incoming line is seized.

(2) Delay - A Delay Start tells the AM7 will delay its readiness to receive digits for the amount of time indicated by the Start Delay parameter.

(3) Wink - A Wink Start tells the AM7 to send a Wink when it is ready to receive digits.

(4) Dial Tone - A Dial Tone Start tells the AM7 to send a Dial Tone when it is ready to receive digits.

3.2.2.3 Dial Tone Delay

```
START DELAY   00
```

The Dial Tone Delay allows changes to be made in the amount of time it takes for a device dialing in to the AM7 to receive a dial tone after it is detected as being off hook. The default time is 0 seconds. A range of Dial Tone Delay time from 0 to 99 seconds may be entered, in 1 second increments. A delay of greater than 0 may be entered to simulate heavy calling volume being placed on the system.

3.2.2.4 Auto Code

```
AUTOCODE YES=1 0
```

The Auto Code entry causes a line to have an automatic Dialing Code match with Dialing Code 8 of its assigned Code Group whenever it goes off hook. The action designated by that Dialing Code is then executed. Dialing Code actions are described in detail later in this manual.

The Auto Code feature allows a sequence of actions to be performed at off hook time, even though no digits have been dialed. The factory default is 0 for NO.

Since the purpose of Auto Code is to have an automatic dialing code match at off-hook without the need of incoming digits, there is generally no need to use a tone receiver. With Auto Code, the dialing code match will be made regardless of the presence or absence of incoming digits.

With the PCM card's T1 interface, a tone receiver on a Tone Receiver Card is not automatically attached when Auto Code is enabled. This is usually not a problem because digits are not normally expected when Auto Code is enabled.

If an application requires a PCM card T1 receiver to be attached to a channel programmed with Auto Code, the attachment is accomplished in one of two ways:

- The receiver can be commanded to be attached by using an Action Code.
- A Dial Tone can be commanded to be sent by using an Action Code. A receiver is automatically attached when a Dial Tone is sent.

3.2.2.5 Confirming Tone

At any time in a test sequence, the AM7 can be programmed to generate one of a group of available frequencies. This "Step Sequence", or group of confirming tones, is commonly used to indicate the completion of a programmed function. See Section 3.4.1.2, Action Code Step Sequences, for further information.

`CONF TONE 0`

Thirteen different tones can be entered that will respond to the "send confirming tone" step sequence command. See Table 3-1, Confirming "Step Sequence" Tones, for further information.

3.2.2.6 Hunt Group

The AM7 can set up calls to be connected from an incoming port to a group of outgoing ports called a Hunt Group. A Hunt Group is a series of telephone lines organized in such a way that if the first line is busy, the second line is tried, and so on until a free line is found. Any number of lines can be designated to be part of from 1 to 8 Hunt Groups. The default hunt group is Hunt Group 1. In other words, a fully configured system would have all 24 T1 channels on a PCM card programmed into Hunt Group 1. To have two equal Hunt Groups, channels 1-12 could be assigned to Hunt Group 1, and channels 13-24 assigned to Hunt Group 2. If a call is directed into a hunt group (by means of an Action Code) that does not exist, a Reorder Tone is generated.

`HUNT GROUP 1`

3.2.2.7 Answer Supervision

```
SUPU Y=1 N=0   1
```

When a called party responds with an Off-Hook condition, the called party's Central Office sends an Answer Supervision signal to the calling party's Central Office. Answer Supervision monitors AM7 lines to ensure that the called party responded with an Off-Hook condition. The default, SUPU Y=1, indicates that all T1 calls switched through the AM7's PCM cards will generate an A,B bit state change for that T1 channel.

3.2.2.8 Dialing Code Group

```
CODE GROUP     A
```

Dialing codes and step sequences, described in detail later in this manual, are similar to the numbering plans used by a digital central office. The sequence of digits allowed, and the steps to perform when those digits are decoded, can be established for the AM7. Dialing codes are contained in Group A thru Group D. Each group contains eight dialing codes of from 1 to 12 expected digits. When a line assigned to a given group matches expected digits, the step sequence associated with those digits is performed. Each dialing code can execute only one step sequence per call. Each line can be assigned to any of the four groups.

3.2.2.9 Dialing Code Report

```
DC RPT Y=1 N=0 1
```

When a line assigned to a dialing code group fails to match any expected digits, or extra digits are received after a match is made, a Dialing Code Error report can be generated. The Dial Code Report default is YES, and prints the digits that were received in error and not decoded.

3.2.2.10 Call Progress Tones

Call Progress Tones are sent from a standard telephone company central office to tell the caller the progress of the call and are simulated by the AM7. The tones are Dial Tone, Ringback, Time Busy, and Reorder, and can be placed in either a NORMAL or LOW setting. See Table 3-2, Call Progress Tone Levels, for further information.

```
TON NOR=1 LO=0 1
```

3.2.2.11 Tone Dial and Dial Pulse Decode

Individual AM7 lines can be set up to accept and decode Tone Dial (TD) digits, Dial Pulse (DP) digits, or both (AL). The Tone Dial and Dial Pulse Decode default is Dial Pulse (DP=2). To select anything other than Dial Pulse, one or more Tone Receiver cards must be installed.

```
TD=1 DP=2 AL=3 3
```

3.2.2.12 Tone Receiver Type Required

The Tone Receiver Type Required display follows the Tone Dial and Dial Pulse Decode display if the AM7 is configured for a PCM T1 card and either Tone (TD=1) or both Tone and Pulse (AL=3) has been previously selected. The required type of tone receiver (decoder): Touch Tone (TT=1) or the factory default setting of Multi Frequency (MF=2) may now be selected.

```
TT=1 MF=2      1
```

3.2.2.13 Flash Time

The Flash Hook is the receiver button that hangs up the phone. If the button is pushed quickly, it can signal the Central Office to perform an action, such as place a call on hold, switch to an incoming call (call waiting), or transfer a call. The factory default set for the minimum amount of time that an incoming line's On Hook state is acknowledged as a Hook Flash is 450ms. A minimum Flash Time of from 50ms to 1245ms may be entered, in 5ms increments. Flash Time may not be entered with a value greater than or equal to Disconnect Time, or the Flash Hook signal will no be recognized before the phone connection is shut down.

```
FLASH TIME  0450
```

3.2.2.14 Disconnect Time

If the receiver button is placed in an On Hook state for a sufficient period of time, the AM7 recognizes that the phone connection has been shut down. The factory default set for the minimum amount of time that each line's On Hook time will be recognized as a disconnect is 1000ms. A minimum Disconnect Time of from 200ms to 1250ms may be entered, in 5ms increments. Disconnect Time must be entered with a value greater than the Flash Time in order for a Flash Hook signal to be recognized.

```
DISC TIME   1000
```

3.2.2.15 Wink Time

A Wink is a momentary interruption, indicating that a Central Office is ready to receive the digits that have just been dialed. It is a single supervisory pulse, signaled by a change in polarity on the line.

The Wink Time is the period of time that the E&M wink (battery/ground reversal) supervision signal remains on the line. The factory default is 250ms. A Wink Time of from 50ms to 950ms may be entered, in 5ms increments.

```
WINC TIME    250
```

3.2.2.16 Call Activity Registers

While the AM7 is operating, it generates a realtime statistical peg count in each line's Call Activity Registers. There are 10 Call Activity Registers, one register to keep track of the call attempts made (ATTEMPTS), one register for each of eight possible Dialing Codes (CODE 1-8), and one register for numbers that don't match a Dialing Code's expected digits (NO CODE).

Each register is updated continuously (to a maximum of 65,535) and can be observed by selecting its line and pressing the Enter/down arrow key until the register appears. To view the same register in all lines, locate the register and press the Enter/right arrow key to step sequentially through each line. The contents of a line's register or all line registers can be printed by using the SPCL (secondary function) key on the keypad.

The Call Attempts Register increments each time the AM7 detects an incoming Off Hook condition on the line. Each time a line's incoming dialing code matches a Dialing Code's expected digits, its Code Register is incremented by one. If a call attempt occurs without a dialing code match, the No Code Register increments by one. Typically, when one match per call is detected, the Call Attempts Register equals the sum of the other 9 registers. However, if single calls create multiple code matches, the Call Attempts Register contains less than the other 9 registers.

```
ATTEMPTS    00000
```

```
CODE 1      00000
```

```
NO CODE    _00000
```

3.2.3 DLC (SLC®96) Card Line Parameters

Each of the DLC Cards (slots 1-4) can be configured to simulate a SLC®96 Span. SLC®96 is a short haul (between 200 yds and 20 miles) multiplexing device which enables up to 96 telephone customers to be served on three pairs of wires. Tone Receiver cards must also be installed in the AM7 if tests require DTMF dialing. The number of cards depends upon the number of DLC cards installed. A SLC®96 Span is capable of operating in two different modes, Mode I and Mode II.

- **MODE I -** Mode I provides 96 carrier channels and dedicates one channel to each subscriber line. This configuration requires four T1 lines. To use the SLC®96 Mode I Option, one to four DLC cards must be installed in the AM7. Each DLC card can send and receive 24 Mode I channels on Spans A, B, C, or D.

  Mode I refers to a nonconcentrated shelf group that is served by two primary T1 lines. Each shelf in the shelf group is served by a dedicated T1 line given the same designation (A, B, C, or D) as the shelf. For example, if shelf group AB is operating in Mode I, its A shelf will be served by the A T1 line and its B shelf by the B T1 line. If all twelve slots of a shelf are filled with dual-circuit channel units, the twenty-four time slots on the T1 line associated with that shelf are fully used. Single-circuit channel units may be substituted for dual-circuit channel units without restrictions, but for each single-circuit channel unit that replaces a dual-circuit unit, one DS1 timeslot on the T1 line will be unused.

- **MODE II -** Mode II concentrates shelf groups of 48 subscriber lines onto 24 carrier channels per shelf group. This configuration requires two main T1 lines per system. To use the SLC®96 Mode II Option, the DLC cards must be installed in slots 1 and/or 3. DLC cards in slots 2 and 4 (if installed) are not operational (if PCM T1 option boards are installed in slots 2 or 4, they must be removed in order to use the SLC®96 Mode II Option). Channels 01 - 48 and alarms are processed by the Span A, and channels 49 - 96 are processed by Span C.

Mode II refers to a shelf group that uses a concentrator and is connected to the Local Digital Switch by one primary T1 line. The A T1 line is used for shelf group AB and the C T1 line is used for shelf group CD. A maximum of 24 dual single party or multiparty channel units may be inserted into the channel unit slots in a Mode II shelf group which results in up to 48 lines competing for the 24 DS1 time slots and yields a 2:1 concentration ratio. Although either dual- or single-circuit channel units can be used in a Mode II shelf group, only the dual-circuit types are concentrated. The concentration ratio remains 2:1 even if single-circuit channel units are substituted for dual-circuit units, since each single-circuit channel unit displaces a dual-circuit channel unit and permanently occupies one DS0 time slot.

In order to maintain sufficient traffic capacity, a minimum of 16 DS0 time slots on each T1 line must be available for concentrated traffic. Hence, a maximum of 8 single-circuit channel units may be present in a Mode II shelf group. Furthermore, in a SLC®96 remote terminal, coin or special service channel units may only be used in the four rightmost channel unit slots of each shelf

`SLC MODE 1A`

When the line number for the DLC card has been entered, the SLC Mode display appears. The following settings are valid for the positions of DLC cards. DLC cards must be in slots 1 and/or 3 to set the SLC Mode to 2A or 2C.

Table 3-4. DLC Card Mode & Span Setting

Slot	Line	Mode and Span Setting
1	Line 100	1A, 1B, 1C, 1D, 2A, 2C
2	Line 200	1A, 1B, 1C, 1D
3	Line 300	1A, 1B, 1C, 1D, 2A, 2C
4	Line 400	1A, 1B, 1C, 1D

DLC line parameters are entered for the 24 channels of each Span (101-124, 201-224, 301-324, 401-424). DLC Card Span Data Registers can be viewed by entering the DLC card slot location via the SEL display (100, 200, 300, or 400). The following Span Data Registers can be viewed by repeatedly pressing Enter to scroll through them.

- TT OFL - Occurs when no Touch Tone tone receiver was available when first requested.
- BPV - Bipolar is the predominant signaling method used for T1 lines. The signal carrying the binary value alternates between positive and negative (1 and 0). A Bipolar Violation is the presence of two consecutive "one" bits of the same polarity on a T1 line.
- SLIP - A SLIP is the condition under which a receiver of a digital signal experiences starvation or overflow in its receive buffer due to a small difference in the speeds of clocks and the clock (transmission rate) at the transmitter. The receiver will drop or repeat a full frame (193 bits on a T1 line) in order to maintain synchronization.
- FERR - A Frame is a group of data bits in a specific format, usually containing its own control information for addressing and error checking, with a flag at each end to indicate the frame's beginning and end. The PCM card uses an ESF (Extended Super Frame) or D4 format. In the 12 bit, D4 frame word, an error is counted when the 12-bit frame word received does not conform to the standard 12-bit frame word pattern.
- SLC®96 Alarm Display - The SLC®96 Alarm Display consists of 12 characters. If no alarms are present the display consists of a series of dashes. If an alarm is detected, the dash is replaced with an "A". The LED position of the "A" corresponds to the type of error.

Table 3-5. SLC®96 Alarm Character Meaning

LED Position	Character Meaning
5	Major Alarm
6	Minor Alarm
7	Power/Misc Alarm
8	A Shelf Alarm
9	B Shelf Alarm
10	C Shelf Alarm
11	D Shelf Alarm
12	A Line Far End Loop (FELP)
13	B Line FELP
14	C Line FELP
15	D Line FELP
16	P Line FELP

Major Alarm - A system state characterized by a loss of service to subscribers served by a shelf or shelf group, exists. If a shelf alarm condition is also present, the shelf alarm indicates the location of the major alarm fault condition.

Minor Alarm - A system state characterized by a non-service affecting fault, exists. If a far end loop condition is also present, the far end loop indicates the location of the minor alarm condition.

Power/Miscellaneous Alarm - A remote terminal site may be configured to allow two or more remote terminals to share common power and maintenance equipment. Each remote terminal can transmit a Power/Miscellaneous alarm. One remote terminal's Power/ Miscellaneous alarm always indicates that AC power is unavailable at the location. The other remote terminal's Power/ Miscellaneous alarms can be used to transmit pre-arranged alarm conditions. An active Power/Miscellaneous alarm shall also raise a major or minor alarm as indicated below:

- For remote terminals located in electronic equipment enclosures, Major Power/Miscellaneous alarms include high temperature, smoke, fire, etc.
- For remote terminals located in controlled environment vaults, Major Power/ Miscellaneous alarms include toxic gas, explosive gas, high water, etc.
- For remote terminals located in electronic equipment enclosures, Minor Power/ Miscellaneous alarms include, for example, an open door.

Shelf Alarms - The four shelf alarm bit patterns, one corresponding to each shelf, indicate that a shelf alarm condition exists. A shelf alarm condition is defined as a system state characterized by the loss of a shelf's operational integrity. A major alarm condition is also indicated whenever a shelf alarm condition exists.

Far End Loop - These five bit patterns, each corresponding to a particular line (A, B, C, D, or P), may be sent to request that the far end loop the incoming digital bit stream to the output bit stream. This permits Operating Company craft to perform single-ended fault locating of the looped digital line from the near end. A minor alarm condition is also indicated whenever a far end loop condition exists. The P-line (over-voltage and/or over-current protection) is unavailable.

Table 3-6. DLC Card Span Data Registers

Data Register	Display
TT OFL - The number of Touch Tone receiver (decoder) overflows. (No TT receiver available when first requested)	TT OFL 00000
BPV - The number of Bipolar Violations for the selected Span.	BPU 00000
SLIP - The number of Frame Slips for the selected Span.	SLIP 00000
FERR - The number of Framing Errors for the selected Span.	FERR 00000
SLC®96 Alarm Display.	---AAAAAAAAAAAA
SLC®96 Version Software. A display-only parameter.	SLC VERSION 01B

Each of the following AM7 Line parameters are described in the order of their displayed appearance.

3.2.3.1 Emulation

EMULATION 2

When a DLC card is being used, each of the 24 DLC line channels can emulate a Ground Start or Loop Start interface. The factory default setting of 2 emulates a Loop Start interface. Ground Start (1) can be used by SLC®96 Mode I only, both Mode I & II can use Loop Start (2) emulation.

3.2.3.2 Trunk Assignment Delay

TCA DELAY 00

The Trunk Assignment Delay parameter is only available for SLC®96 simulation Mode II operation via a DLC card. The TCA DELAY, with a factory default of 00 seconds, simulates congestion on a SLC®96 Span. A range of TCA Delay time from 00 to 99 seconds may be entered, in 1 second increments.

3.2.3.3 Dial Tone Delay

```
START DELAY   00
```

The Dial Tone Delay allows changes to be made in the amount of time it takes for a device dialing in to the AM7 to receive a dial tone after it is detected as being off hook. The default time is 0 seconds. A range of Dial Tone Delay time from 0 to 99 seconds may be entered, in 1 second increments. A delay of greater than 0 may be entered to simulate heavy calling volume being placed on the system.

3.2.3.4 Auto Code

```
AUTOCODE YES=1 0
```

The Auto Code entry causes a line to have an automatic Dialing Code match with Dialing Code 8 of its assigned Code Group whenever it goes off hook. The action designated by that Dialing Code is then executed. Dialing Code actions are described in detail later in this manual.

The Auto Code feature allows a sequence of actions to be performed at off hook time, even though no digits have been dialed. The factory default is 0 for NO.

Since the purpose of Auto Code is to have an automatic dialing code match at off-hook without the need of incoming digits, there is generally no need to use a tone receiver. With Auto Code, the dialing code match will be made regardless of the presence or absence of incoming digits.

With the DLC card's SLC®96 interface, a tone receiver on a Tone Receiver Card is not automatically attached when Auto Code is enabled. This is usually not a problem because digits are not normally expected when Auto Code is enabled.

If an application requires an SLC®96 receiver to be attached to a channel programmed with Auto Code, the attachment is accomplished in one of two ways:

- The receiver can be commanded to be attached by using an Action Code.
- A Dial Tone can be commanded to be sent by using an Action Code. A receiver is automatically attached when a Dial Tone is sent.

3.2.3.5 Confirming Tone

At any time in a test sequence, the AM7 can be programmed to generate one of a group of available frequencies. This "Step Sequence", or group of confirming tones, is commonly used to indicate the completion of a programmed function. Step Sequences are discussed in detail in the section on Dialing Codes.

```
CONF TONE       0
```

Thirteen different tones can be entered that will respond to the "send confirming tone" step sequence command. See Table 3-1, Confirming "Step Sequence" Tones, for further information.

3.2.3.6 Hunt Group

The AM7 can set up calls to be connected from an incoming port to a group of outgoing ports called a Hunt Group. A Hunt Group is a series of telephone lines organized in such a way that if the first line is busy, the second line is tried, and so on until a free line is found. Any number of lines can be designated to be part of from 1 to 8 Hunt Groups. The default hunt group is Hunt Group 1. A fully configured system would have all 24 T1 channels on a DLC card programmed into Hunt Group 1. To have two equal Hunt Groups, channels 1-12 could be assigned to Hunt Group 1, and channels 13-24 assigned to Hunt Group 2. If a call is directed into a hunt group that does not exist, a Reorder Tone is generated.

```
HUNT GROUP      1
```

3.2.3.7 Dialing Code Group

Dialing codes and step sequences, described in detail later in this manual, are similar to the numbering plans used by a digital central office. The sequence of digits allowed, and the steps to perform when those digits are decoded, can be established for the AM7. Dialing codes are contained in Group A thru Group D. Each group contains eight dialing codes of from 1 to 12 expected digits. When a line assigned to a given group matches expected digits, the step sequence associated with those digits is performed. Each dialing code can execute only one step sequence per call. Each line can be assigned to any of the four groups.

```
CODE GROUP      A
```

3.2.3.8 Dialing Code Report

`DC RPT Y=1 N=0 1`

When a line assigned to a dialing code group fails to match any expected digits, or extra digits are received after a match is made, a Dialing Code Error report can be generated. The Dial Code Report default is YES, and prints the digits that were received in error and not decoded.

3.2.3.9 Call Progress Tones

`TON NOR=1 LO=0 1`

The Call Progress Tones generated by a standard telephone company central office are simulated by the AM7. The tones are Dial Tone, Ringback, Time Busy, and Reorder, and can be placed in either a NORMAL or LOW setting. See Table 3-2., Call Progress Tone Levels, for further information.

3.2.3.10 Tone Dial and Dial Pulse Decode

`TD=1 DP=2 AL=3 3`

Individual AM7 lines can be set up to accept and decode Tone Dial (TD) digits, Dial Pulse (DP) digits, or both (AL). The Tone Dial and Dial Pulse Decode default is Dial Pulse (DP=2). Tone Dial (TD=1) or both (AL=3) must be selected if DLC card operation requires DTMF dialing.

3.2.3.11 Flash Time

The Flash Hook is the receiver button that hangs up the phone. If the button is pushed quickly, it can signal the Central Office to perform an action, such as place a call on hold, switch to an incoming call (call waiting), or transfer a call.

`FLASH TIME  0450`

The factory default set for the minimum amount of time that an incoming line's On Hook state is acknowledged as a Hook Flash is 450ms. A minimum Flash Time of from 50ms to 1245ms may be entered, in 5ms increments. Flash Time may not be entered with a value greater than or equal to Disconnect Time, or the Flash Hook signal will no be recognized before the phone connection is shut down.

3.2.3.12 Disconnect Time

If the receiver button is placed in an On Hook state for a sufficient period of time, the AM7 recognizes that the phone connection has been shut down. The factory default set for the minimum amount of time that each line's On Hook time will be recognized as a disconnect is 1000ms. A minimum Disconnect Time of from 200ms to 1250ms may be entered, in 5ms increments. Disconnect Time must be entered with a value greater than the Flash Time in order for a Flash Hook signal to be recognized.

```
DISC TIME   1000
```

3.2.3.13 Wink Time

A Wink is a momentary interruption, indicating that a Central Office is ready to receive the digits that have just been dialed. It is a single supervisory pulse, signaled by a change in polarity on the line.

The Wink Time is the period of time that the E&M wink (battery/ground reversal) supervision signal remains on the line. The factory default is 250ms. A Wink Time of from 50ms to 950ms may be entered, in 5ms increments.

```
WINC TIME    250
```

3.2.3.14 Timeslot Register

In time division multiplexing or switching, a timeslot is the slot belonging to a voice, data, or video conversation. It can be occupied with conversation or left blank, but the slot is always present. Twenty-four timeslots are assigned per channel bank. The Timeslot Register displays the current timeslot assigned to a channel. This display-only register appears during SLC®96 Mode II operation. The timeslot value is zero unless it is automatically assigned by the AM7 to a channel during SLC®96 Mode II operation; then the value may range from 01 to 24.

```
TIMESLOT      00
```

3.2.3.15 Call Activity Registers

While the AM7 is operating, it generates a realtime statistical peg count in each line's Call Activity Registers. There are 10 Call Activity Registers, one register to keep track of the call attempts made (ATTEMPTS), one register for each of eight possible Dialing Codes (CODE X), and one register for numbers that don't match a Dialing Code's expected digits (NO CODE).

Each register is updated continuously (to a maximum of 65,535) and can be observed by selecting its line and pressing the Enter/down arrow key until the register appears. To view the same register in all lines, locate the register and press the Enter/right arrow key to step sequentially through each line. The contents of a line's register or all line registers can be printed by using the SPCL (secondary function) key on the keypad. The Call Attempts Register increments each time the AM7 detects an incoming Off Hook condition on the line. Each time a line's incoming dialing code matches a Dialing Code's expected digits, its Code Register is incremented by one. If a call attempt occurs without a dialing code match, the No Code Register increments by one. Typically, when one match per call is detected, the Call Attempts Register equals the sum of the other 9 registers. However, if single calls create multiple code matches, the Call Attempts Register contains less than the other 9 registers.

```
ATTEMPTS   00000
CODE 1     00000
NO CODE   _00000
```

3.3 DTMF Dialing Analyzer Operation

The AM7's DTMF Dialing Analyzer (Analyzer) provides detailed analysis of a source generating DTMF and MF tones in order to verify that it is operating properly. The Analyzer monitors a line during a call and reports each tone event that occurs, giving a record of the signals produced by the source of the call.

3.3.1 Tone Events

A Tone Event is created each time tones are applied to the Analyzer.

Between digits, a telephone mouthpiece is open to the line, and any background noise is transmitted across the line. This noise can cause spurious events, since the Analyzer's sensitivity is biased toward reporting rather than ignoring events.

A tone with a level greater than -40dBm and a frequency within one of the tone dial bands is normally considered a tone signal. The Analyzer's band splitting and dial tone reject filters attenuate out-of-band signals. Out-of-band signals require a higher level to be recognized as a tone signal.

The Analyzer processes signals with up to +/-18dB of twist, with reduced accuracy for more than +/-8dB. If one tone is more than 18dB less than the other, the stronger tone is reported as a single tone event.

When a tone is recognized, it is seen as ON until its level drops 6dB from its highest point. If the tone increases until it is more than 18dB higher than the other, the other tone is seen as OFF and an additional event is generated. When a tone drops by 6dB, it is seen as OFF and a tone event is recorded for the time preceding the drop. If however, the new level remains above -40dBm, and greater than -18dB in relation to the other tone, it is again seen as ON.

The tone events are collected until the monitored call is completed, then they are output in a Tone Dial Report. The values in the Tone Dial Report are checked against system programmed limits and out-of-tolerance parameters are flagged with an asterisk. Event Identification, Frequency and Percent Deviation, Level, Twist, and Timing is given for each event.

3.3.1.1 Tone Event Identification

A valid Tone Event may be a number (0 - 9), a letter (A-D), or a character (* and #). The criteria for the validity of tone dialing digits are relaxed in order to show marginal or defective signals produced from the source of the call.

- A period or dot (Single Tone) on the Tone Dial Report indicates that a single tone was received, with that level and frequency shown under the appropriate band.
- A question mark (Invalid Tone Pair) indicates a tone pair not recognized as valid by the Analyzer.
- An exclamation point (Skew) indicates that one tone began 2ms or more before the other tone. The maximum duration of a skew is 13ms. If the tone source's keypad has separate contacts to enable the two tones, relatively long skew times can occur due to mismatched switch contacts. If a skew goes beyond 13ms, the leading tone is seen as a single tone event.

A strong single tone near 1066Hz is received by both bands causing the Analyzer to see a tone pair. Therefore, the Analyzer ignores low band tones greater than 1066Hz and high band tones less than 1067Hz. If however, a 1066Hz tone causes the Analyzer to see a tone pair, an Invalid Pair (?) event is created.

3.3.1.2 Frequency and Percent Deviation

The frequency of each tone and the deviation in the frequency are provided on the Tone Dial Report. The frequency is based on an 18ms measurement interval that terminates 6ms to 12ms prior to the end of an event. The frequency is accurate for a tone active for at least 25ms, and less accurate for shorter tones due to a shorter measurement interval. Skew events generate a Tone Dial Report frequency if they are 7ms or longer.

Frequency measurements may not be accurate during and shortly after large DC transients on the line. These transients are caused by On Hook or Off Hook transitions, Winks or Supervision changes. Typical errors in these cases are less than 10Hz. Deviation percentage is defined as 100(fm-fn)/fn, where fm is the measured frequency and fn is the nearest nominal touch tone frequency.

3.3.1.3 Level

The tone level that appears on the Tone Dial Report is the level of the tone 12ms to 18ms prior to the end of the event. The level is accurate for a tone active for at least 13ms. The shorter length skew level value is the level of the first tone after it begins and 0ms to 6ms before the second tone begins. Level measurements, just as frequency measurements, are affected by DC transients. Typical errors in these cases are less than 1dB (additive).

3.3.1.4 Twist

The Twist value is not directly measured. It is the difference between the high band level and the low band level shown on the Tone Dial Report.

3.3.1.5 Event Timing

The Analyzer is programmed to account for all elapsed time by control of the Event Timer. The Event Timer is incremented once per millisecond. The time reported in the Tone Dial Report for each event during a call is subtracted from the event time. Therefore, the total time of the call is determined by adding the Tone Dial Report event times to the time left on the event timer. OFF Time is the duration of the quiet interval (both bands less than -40dBm) prior to a tone event. If one tone event follows another, with no quiet time between them, the OFF Time is 0. ON Time is the duration of the tone event. Timing usually begins at the end of a quiet interval. If there is no detected quiet interval, timing begins at the end of the last reported tone event. Each tone event must meet a minimum time threshold in order to be printed in the Tone Dial Report. If an event is too short to be detected, it is included in the OFF or ON Time of the next detected event. This is dealt with as follows:

- If there is Quiet, an undetected event, then Quiet, they are all included in the OFF Time of the next detected event.
- If there is Quiet, an undetected event, then a second detected event, the undetected event is included in the ON Time of the second detected event.

- If there is a first detected event, an undetected Quiet, then a second detected event, the undetected Quiet is included in the ON Time of the second detected event, which has a 0 OFF Time.
- If there is a first detected event, an undetected event, then a second detected event, the undetected event is included in the ON Time of the second detected event, which has a 0 OFF Time.

Guard Time is used to screen out short events. Any event with ON Time shorter than the Guard Time is ignored and its time is added to the OFF Time of the next detected event. This is useful when a defect in the source that generates the call creates many undetectable events.

3.4 Dialing Codes

All lines of the AM7 can be programmed with a numbering plan in the same way as a Central Office or PABX switch. The numbering plan defines what received digits the switch should match, and the action the switch should take when a match is made.

The numbering plan is implemented with "Dialing Codes" which define the response of the AM7 (through the use of Action Code sequences) to received dialed digits. Dialing codes are generated into the AM7 from any suitable dialing or signaling source, such as an Ameritec Bulk Call Generator, or any standard rotary dial or touch tone telephone. Four different Dialing Code Groups (A - D) can be programmed into the unit. For each Dialing Code Group up to 8 Expected Digit fields can be programmed. Each Expected Digit field can hold up to 12 digits. The Expected Digit field can be programmed to match DTMF or MF digits, "any" digit, hook flashes, or perform an Automatic Sequence ("Auto Code"). The Expected Digit fields within a Dialing Code Group can be coordinated to create a Dialing Code of up to a maximum of 96 digits in length.

In summary, in order for the AM7 to operate, it must be programmed to expect a specific sequence of dialed digits (dialing code). The AM7 only reacts to incoming dialing codes that match the programmed sequence, otherwise it generates a reorder signal. Once the incoming digits are matched, as many as 8 functions can be performed through previously programmed Action Codes.

3.4.1 Dialing Code Programming

A maximum of eight dialing codes can be programmed into each Dialing Code Group (A-D). The Dialing Code Worksheet is an essential part of dialing code programming, providing a ready reference of the testing values that have been entered into the AM7.

In order to enter a Dialing Code, the type of line (0 for analog, 1-4 for Spans), group (A-D) and dialing code number (1-8) must be entered. If, as an example, it is necessary to enter information into Dialing Code 4 of Group B of an analog line, press SEL, type in 0B4, and press Enter.

```
0B4 _
```

The display will show "0B4" followed by a blinking cursor. This is a prompt requesting the entry of up to 12 (or more) digits that may be expected by the AM7.

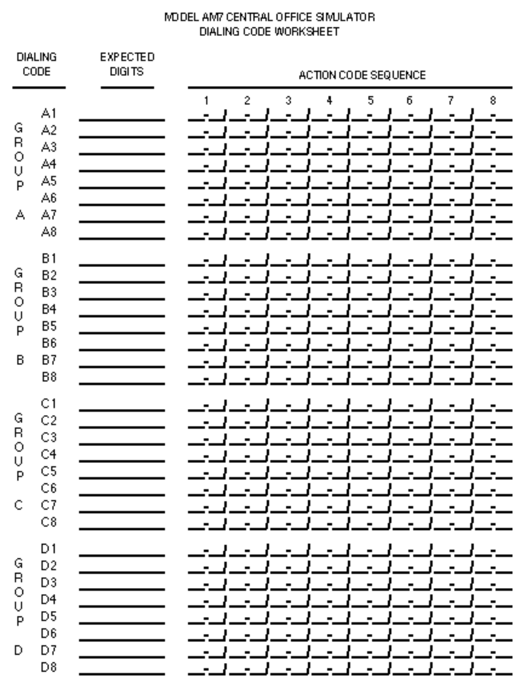


Figure 3-1. Dialing Code Worksheet

3.4.1.1 Expected Digit Field

The expected digit field contains a string of digits that must be matched in order to activate an Action Code sequence.

Table 3-7. Expected Digit Field Definitions

Character	Meaning
0 - 9	Normal dialed digits.
A - D	A - D used in tone dialing.
- (Wildcard Digit)	Any normal dialed digit filling this position is accepted as a match.
FLASH	Hook Flash. On Hook lasting longer than Flash Time, but less than Disconnect Time.
BLANK	End of string.

As an example, the entry 99999-- in the expected digit field indicates that the AM7 expects to see seven digits; five 9's followed by any two normal dialed digits. An entry of 123--67 causes the AM7 to expect seven digits; 123 followed by any two normal dialed digits, followed by 67. An entry of 123 BLANK 456 causes the AM7 to expect three digits; 123, since BLANK ends the expected digit string.

Special entries are required when the AM7 is required to process Multi-Frequency digits. When expecting MF digits, the AM7 must see a "KP" (key press) digit in the expected digit field before it will accept any MF digits. This tells the AM7 to get ready to process the MF digits to follow. If a string of MF digits is not preceded by a KP digit, the MF digits will not be recognized. When the AM7 receives an "ST" digit, it starts processing the MF digits it has received and performs the actions designated by them. It doesn't recognize any further MF digits until another KP digit is received. The type of ST digit programmed into the expected digit field depends upon the type of ST digit to which the AM7 is required to respond.

Table 3-8. MF Expected Digit Field Definitions

Character	Meaning
KP	MF receiver enabler. Enter a KP digit by pressing the *([) key on the AM7 keypad. The KP digit is represented by an asterisk on the display.
ST, ST3P, STP, ST2P	MF receiver disabler. Enter an ST digit by pressing the # (]) key on the AM7 keypad. The ST digit is represented by a pound sign on the display.

3.4.1.2 Action Code Step Sequences

In order to enter an Action Code Step for a Dialing Code, enter a Dialing Code such as 0B4. When the prompt for the expected digits appears, enter the digits to be expected by the AM7. The Action Code Sequence display is the next to appear. Enter one of the 27 dialing code actions that can be taken by the AM7. When the code is typed in and the ETR↓ key is pressed, the display automatically moves to Step 2, and continues to move to the next step, when ETR↓ is pressed, for up to a maximum of 8 steps. If 00-00 is entered for the last step, pressing the ETR↓ key causes the next dialing code entry display (0B5) to appear. If the ETR→ key is pressed after the data for the Dialing Code's (0B4) step is entered, the same step's display for the next Dialing Code (0B5) appears. If SHIFT is pressed, then the ETR↑ key is pressed, the Dialing Code's step is entered and the display returns to the previous step entered.

```
0B4 STEP 1 00-00
```

The AM7 is shipped from Ameritec with a factory default Dialing Code expected digit program of 99999--. When the number 99999 is dialed, followed by an installed line's number (01-20), the AM7 responds by applying ringing to the line number dialed, and ringback to the incoming line. This default setting provides a convenient quick check of AM7 operation.

Table 3-9. Action Code Definitions

Action Code	Action to be Taken
00-00	No action (end of Action Code Sequence).
01-nn	Wait for nn seconds before going to the next programmed step.
02-nn	Provide ringback for nn seconds.
03-nn	Provide reorder for nn seconds.
04-nn	Provide line busy for nn seconds.
05-nn	Provide dial tone for nn seconds.
06-00	Provide dial tone until a digit is received.
07-nn	Send confirming tone for nn seconds.
08-nn	Send digital milliwatt (1000Hz @ 0.0dBm) for nn seconds.

Action Code	Action to be Taken
09-nn	Setup call from incoming port to outgoing port. The outgoing port is selected by the last two dialed digits. If the outgoing port is idle, apply ringback to the incoming port, apply ringing and detect answer by outgoing port. Answer must be by a device, such as a modem, telephone, Bulk Call Generator, etc. The answer is detected by the AM7 and ringback ceases. A speech path and supervisory channel is established.
10-nn	Setup call from incoming port to the outgoing ports of one of up to 8 hunt groups. The group is selected by the last dialed digit. If nn = 00, the group is selected by the last dialed digit in the expected digits entry. If nn = 01-08, the call is directed to the first available port within that hunt group.
11-00	Generate a wink. If Loop/Gnd Start, the polarity is reversed during the Wink. If E&M, the M lead is true during the Wink.
12-00	Provide Answer Supervision. If Loop/Gnd Start, the polarity is reversed during Answer Supervision. If E&M, the M lead is true during Answer Supervision.
13-00	Remove Answer Supervision.
14-00	Send 400Hz for nn seconds.
15-00	Send 400Hz until a digit is received.
16-00 SIT Tones	There are 6 sets of Special Information Tones (SIT), provided by the AM7 to simulate what a caller hears, NOT to cause a switch to react. SIT tones may be used for number not in service, number changed, circuit busy, etc.
16-01	Send Vacant Code SIT sequence: 980Hz for 380ms, 1370Hz for 275ms, and 1780Hz for 380ms.
16-02	Send No Circuit-BOC SIT sequence: 980Hz for 380ms, 1430Hz for 380ms, and 1780Hz for 380ms.
16-03	Send Intercept SIT sequence: 910Hz for 275ms, 1370Hz for 275ms, and 1780Hz for 380ms.
16-04	Send Reorder-BOC SIT sequence: 910Hz for 275ms, 1430Hz for 380ms, and 1780Hz for 380ms.
16-05	Send Reorder-Carrier SIT sequence: 980Hz for 275ms, 1370Hz for 380ms, and 1780Hz for 380ms.
16-06	Send No Circuit-Carrier SIT sequence: 910Hz for 380ms, 1370Hz for 380ms, and 1780Hz for 380ms.
17-00	Ignore dialed digits.

Action Code	Action to be Taken
18-00	Accept dialed digits
19-nn	Span 1 - corresponds to 09-nn for Analog lines.
20-nn	Span 2 - corresponds to 09-nn for Analog lines.
21-nn	Span 3 - corresponds to 09-nn for Analog lines.
22-nn	Span 4 - corresponds to 09-nn for Analog lines.
23-00	Release PCM/DLC Tone Receiver.
24-00	Release Tone Analyzer.
25-00	Release Dial Pulse Analyzer.
26-nn	Attach PCM/DLC Tone Receiver. 00 = Attach Tone Receiver programmed for the line. 01 = Attach Touch Tone Receiver. 02 = Attach MF Receiver. Do not use "02" for DLC channels.

Action Codes 19 - 22 switch calls from an incoming port to an outgoing port, apply ringing, return ringback, detect answers and establish speech and supervisory paths. For example, 20-13 means for the call to be directed to Channel 13 of Span 2.

4. PROGRAMMING EXAMPLES AND TESTS

AM7 Dialing Code programming examples and switching and test applications are described in this section.

4.1 Dialing Code Programming

The AM7 Central Office Simulator Dialing Code Worksheet (shown on the following page) is an essential part of the AM7 programming, especially for those just beginning to understand the power of the unit.

Note that the Dialing Code Worksheet is broken down into four basic sections, each representing one of the four Dialing Code Groups. Note also that the worksheet is filled out with two factory default numbers: 99999-- and *99999--#.

4.1.1 Analog Line Programming

An expected number sequence of 99999-- means that the AM7 will respond with ringing to a line number when it recognizes 99999 plus two digits. Since the factory default is programmed with "--" (the "Match Any Digit" or "Don't Care" character, any two digits can be appended to the expected digits of 99999. Thus if 99999 plus 12 is dialed, the AM7 will apply ringing to line "12" if it is installed.

4.1.2 Multi-Frequency (MF) Programming

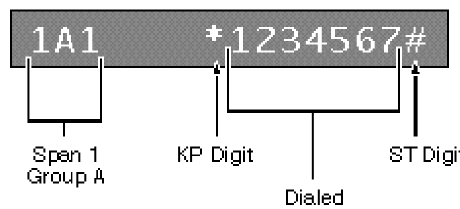
When expecting MF digits, the AM7 <u>must</u> see a "KP" digit before it will accept the expected digits in the MF dialing code. A KP digit acts like a switch to <u>enable</u> an MF receiver. If a series of MF digits <u>is not</u> preceded by a KP digit, the AM7 will not recognize the MF digits.

To enter a KP digit into the expected digit field, press the *([) key on the AM7's program keyboard, or enter an "*" (asterisk) from the terminal keyboard. On the display, the KP digit appears as an "*" (asterisk).

Also, depending upon the application, it may be necessary to enter an "ST" digit after the expected digits in the MF dialing code. An ST digit acts like a switch to disable an MF receiver. When the AM7 receives an ST digit, it no longer recognizes MF digits until another KP digit is received.

To enter an ST digit in the expected digit field, press the #(]) key on the AM7's program keyboard, or enter a "#" (pound) from the terminal keyboard. On the display, the ST digit appears as an "#" (pound).

A expected digit field is entered for an MF dialing code by keying in the Span and Group number (1A1), a KP digit (*) to enable the MF receiver, the expected MF digits (1234567), and an ST digit (#) to disable the MF receiver.



The AM7 doesn't require a KP digit when expecting DTMF (Touch Tone) digits.

There are four (4) possible digits that the AM7 will recognize as an ST digit. The KP and the four (4) ST digits are listed along with the frequencies of the tone pairs.

Table 4-1. KP/ST Digit Tone Pairs

Name	Key	MF Tone Pairs (Hz)
KP	*	1100/1700
ST	#	1500/1700
ST3P	A	700/1700
STP	B	900/1700
ST2P	C	1300/1700

4.2 Programming Examples

The following AM7 programming examples show the Dialing Code Worksheet completed to match the example used.

- PBX Station Calling a Central Office Milliwatt (Test Tone) Source
- Simulation of a Telephone Company Central Office Used in Switching Calls Generated by Autodial Modems Located at a Remote Site into a Computer Center's Auto Answer Modem(s)
- AM7 Accommodation of an Expected Dialed Digit String Longer than 12 Digits

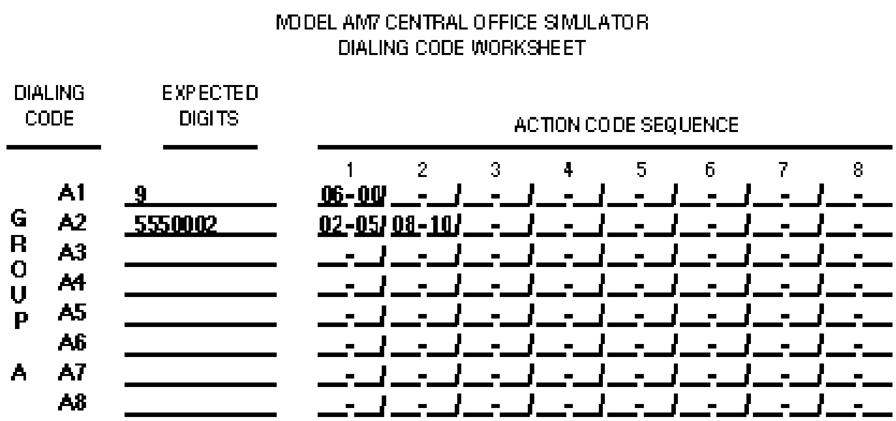
MODEL AM7 CENTRAL OFFICE SIMULATOR
DIALING CODE WORKSHEET

	DIALING CODE	EXPECTED DIGITS	ACTION CODE SEQUENCE 1	2	3	4	5	6	7	8
GROUP A	A1	99999-	09-00	-	-	-	-	-	-	-
	A2	*99999-#	09-00	-	-	-	-	-	-	-
	A3		-	-	-	-	-	-	-	-
	A4		-	-	-	-	-	-	-	-
	A5		-	-	-	-	-	-	-	-
	A6		-	-	-	-	-	-	-	-
	A7		-	-	-	-	-	-	-	-
	A8		-	-	-	-	-	-	-	-
GROUP B	B1		-	-	-	-	-	-	-	-
	B2		-	-	-	-	-	-	-	-
	B3		-	-	-	-	-	-	-	-
	B4		-	-	-	-	-	-	-	-
	B5		-	-	-	-	-	-	-	-
	B6		-	-	-	-	-	-	-	-
	B7		-	-	-	-	-	-	-	-
	B8		-	-	-	-	-	-	-	-
GROUP C	C1		-	-	-	-	-	-	-	-
	C2		-	-	-	-	-	-	-	-
	C3		-	-	-	-	-	-	-	-
	C4		-	-	-	-	-	-	-	-
	C5		-	-	-	-	-	-	-	-
	C6		-	-	-	-	-	-	-	-
	C7		-	-	-	-	-	-	-	-
	C8		-	-	-	-	-	-	-	-
GROUP D	D1		-	-	-	-	-	-	-	-
	D2		-	-	-	-	-	-	-	-
	D3		-	-	-	-	-	-	-	-
	D4		-	-	-	-	-	-	-	-
	D5		-	-	-	-	-	-	-	-
	D6		-	-	-	-	-	-	-	-
	D7		-	-	-	-	-	-	-	-
	D8		-	-	-	-	-	-	-	-

Figure 4-1. Dialing Code Worksheet

4.2.1 PBX Station Calling a Test Tone Source

The first example is programming the AM7 to respond to a PBX station calling a Central Office Milliwatt (test tone) source. This test is useful in determining the ability of the device under test to dial the correct digits and receive a test tone. The loss of frequency caused by the device under test (PBX) can then be measured. The sequence of events, as reflected on the following worksheet section, is as follows:


MODEL AM7 CENTRAL OFFICE SIMULATOR
DIALING CODE WORKSHEET

	DIALING CODE	EXPECTED DIGITS	ACTION CODE SEQUENCE 1	2	3	4	5	6	7	8
GROUP A	A1	9	06-00	-	-	-	-	-	-	-
	A2	5550002	02-05	08-10	-	-	-	-	-	-
	A3		-	-	-	-	-	-	-	-
	A4		-	-	-	-	-	-	-	-
	A5		-	-	-	-	-	-	-	-
	A6		-	-	-	-	-	-	-	-
	A7		-	-	-	-	-	-	-	-
	A8		-	-	-	-	-	-	-	-

Figure 4-2. PBX Station Calling a Test Tone Source

1. Station Goes Off Hook.

The AM7 provides a dial tone after a programmed delay of from 00 - 99 seconds. Remember that the dial tone delay is set up when Line Setup parameters are programmed.

2. PBX Station Dials a "9".

The AM7 waits for the expected digit "9", and then provides a second dial tone until any other digit is received. Action Code 06-00 provides the dial tone until a digit is received.

3. PBX Station Waits for a Second Dial Tone and Dials Any Programmed Milliwatt Telephone Number (5550002).

The AM7 waits for the expected digits 5550002. Once received, the AM7 is programmed to transmit a Milliwatt test tone (1000Hz at 0.0dBm) for 10 seconds. Action Code 02-05 provides a ringback for 5 seconds. Action Code 08-10 generates the digital milliwatt, which is 1000Hz at 0.0dBm, for 10 seconds. The PBX Station receives a 1000Hz tone for 10 seconds.

4.2.2 Central Office Modem Switching

The second example is to illustrate how the AM7 can be programmed to simulate a telephone company central office used in switching calls generated by autodial modems located at a remote site into a computer center's auto answer modem(s). The sequence of events, as reflected on the following worksheet section, is as follows:

MODEL AM7 CENTRAL OFFICE SIMULATOR
DIALING CODE WORKSHEET

	DIALING CODE	EXPECTED DIGITS	ACTION CODE SEQUENCE 1	2	3	4	5	6	7	8
GROUP A	A1	9	06-00							
	A2	5550002	02-05	08-10						
	A3									
	A4									
	A5									
	A6									
	A7									
	A8									
GROUP B	B1									
	B2									
	B3	555121213	09-00							
	B4									
	B5									
	B6									
	B7									
	B8									

Figure 4-3. Central Office Modem Switching

1. Autodial Modem Goes Off Hook.

The AM7 provides a dial tone after a programmed delay of from 00 - 99 seconds. Remember that the dial tone delay is set up when Line Setup parameters are programmed. If the application is to simulate a modem served by a PBX where a second dial tone is used, the dialing code and step sequences in the previous example can be used.

2. Modem Dials Simulated Computer Center Number (5551212 + 13).

The AM7 waits for the expected digits 555121213. If there is a match, the AM7 proceeds to the programmed step sequences. Remember that if the AM7 doesn't match the expected digits, it will generate a reorder signal after 15 seconds. In this example, the unit has been programmed to setup a call from the incoming port to the selected outgoing port. The outgoing port number is "13" because Action Code 09-00 was selected.

Action Code 09-00 means that the last two digits of the expected digits represent the outgoing port number to which the call is to be directed. Therefore, a call is set up from the incoming port to port number 13. Ringing is provided to the outgoing port and ringback is provided to the incoming port.

3. The Modem Simulating the Central Computer Site Attached to Port #13 Receives Ringing, Answers the Call, and Generates It's Answerback Tone.

The AM7 detects the answer by outgoing port #13 and establishes a data communications path.

4. The Two Modems, Now Connected Through the AM7 Central Office Simulator, Can Exchange Data Communications or be Disconnected.

4.2.3 Expected Digits in Excess of 12 Digits

The third example examines how an expected dialed digit string longer than 12 digits can be accommodated by the AM7. Possible applications for programming the unit to act upon long digit strings would be non-equal access, central office inter-machine trunk testing, ANI simulation, etc. The sequence of events, as reflected on the following worksheet section, is as follows:

MODEL AM7 CENTRAL OFFICE SIMULATOR
DIALING CODE WORKSHEET

	DIALING CODE	EXPECTED DIGITS	ACTION CODE SEQUENCE 1	2	3	4	5	6	7	8
GROUP A	A1	9	06-00							
	A2	5550002	02-05	08-10						
	A3									
	A4									
	A5									
	A6									
	A7									
	A8									
GROUP B	B1									
	B2									
	B3	555121213	09-00							
	B4									
	B5									
	B6	415555121281								
	B7	85415441	01-05	09-01						
	B8									

Figure 4-4. Expected Dialing Code Longer than 12 Digits

1. The Device Under Test Goes Off Hook.

The AM7 provides a dial tone after a programmed delay of from 00 - 99 seconds. Remember that the dial tone delay is set up when Line Setup parameters are programmed.

2. **The Device Under Test Dials the String of Digits. The Following Digits are Dialed Simulating a Calling and Called Number in a Non-equal Access Transmission.**

The Called Party's digits are 4155551212, while the Calling Party's digits are 818-541-5441.

The AM7 decodes the expected digits 41555512128185415441. The first twelve digits are received as expected by the AM7. Once decoded, the unit determines that there are no Action Codes associated with the first twelve digits, so no action is taken at this time. The AM7 automatically readies itself to decode additional incoming digits.

As a result, the incoming digits 415555121281 are the expected digits for the first portion of the dialing sequence. The balance of the incoming digits 85415441 are in the next code's Expected Digits field. The AM7 decodes the digits and examines the programmed step sequences. The first example step sequence used is 01-05, which causes the AM7 to wait for 5 seconds before proceeding to the next step.

Step sequence 09-01 directs the call to line "01", applies ringback to the incoming port, detects the answer by the outgoing port (port 01), and establishes a speech and supervisory path through the AM7.

4.3 Switching and Test Applications

There are numerous applications in which the Ameritec Model AM7 Central Office Simulator can provide switching and test functions. Since the AM7 is a 20-line electronic non-blocking programmable switch, it can be configured to meet a wide variety of test applications. The AM7 can be used as a serving central office, toll office, equal access switch, tandem switch, etc.

Several of the possible test applications require an ancillary device to generate telephone calls into the AM7 Central Office Simulator, such as a rotary dial or Touch Tone telephone, or autodial modem.

4.3.1 Basic Dialing Test

The signaling output of dial pulse or DTMF telephones, or devices such as autodial modems, PBX's, etc., can be tested by simply connecting the devices to the AM7, without the need for installing expensive telephone lines for test purposes.

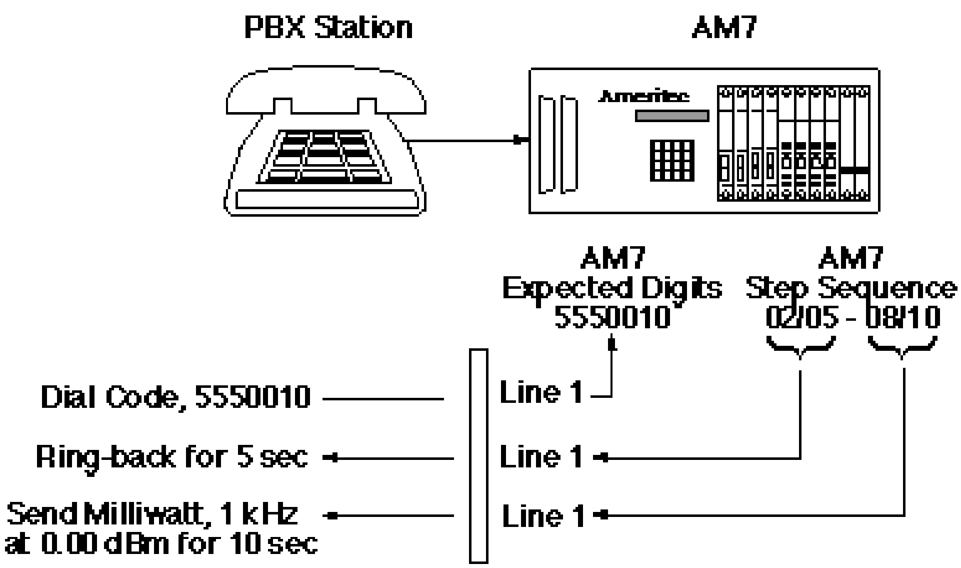


Figure 4-5. Basic Dialing Test

Since the AM7 is a 20-line electronic switch, 20 devices can be connected, 10 for outgoing calls and 10 for incoming calls, or all 20 lines for incoming calls. Line and System Setup and Programming, discussed in Section 3, provides a detailed description of how the AM7 can be programmed to react to incoming dialed digits.

A listing of some of the incoming and outgoing call simulation features of the AM7 is shown below:

Incoming:

- Detects ring ground and provides tip ground for ground start simulation.
- Senses loop closure, or E lead seizure.
- Provides dial tone, or wink on E&M.
- Decodes and analyzes dial pulse digits and optionally analyzes and reports the level, frequency and timing of DTMF and MF signals.
- Confirms expected digits and performs specified actions.
- Senses idle (disconnect), and prepares for a new call.

Outgoing:

- Triggered by decoding expected digits and executing programmed step sequences.
- Applies ringing voltage to tip and ring, or sets the M lead true on the E&M lead on the outgoing port.
- Applies a ringback tone to the incoming port.
- Waits for a ring trip, or E lead true on the E&M lead on the outgoing port.
- Establishes a speech and supervisory path between incoming and outgoing ports.
- Waits for the incoming port to release the connection.

4.3.2 Autodial Modem Test

The call signaling capability and accuracy of autodial modems can easily be tested by connecting up to 20 modems to the AM7. The incoming and outgoing call simulation modes described in the Basic Dialing Test are applicable to autodial modem testing.

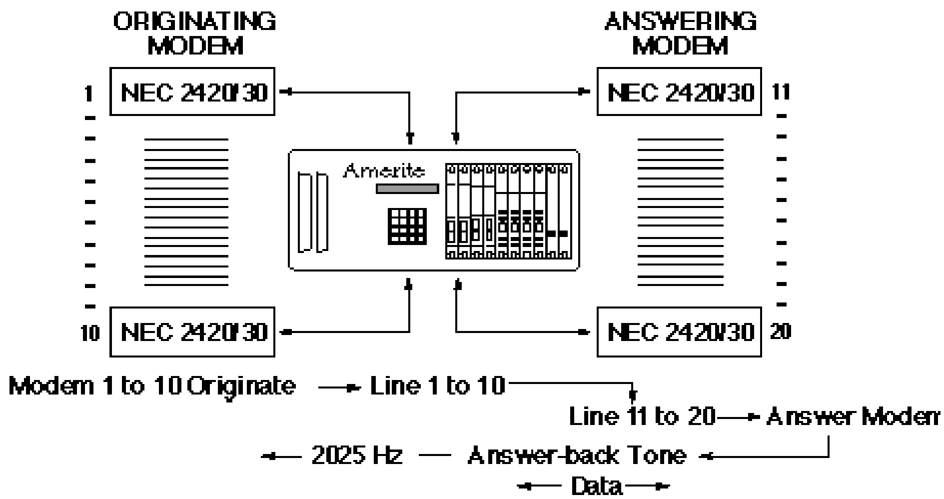


Figure 4-6. Autodial Modem Test

Telephone numbers programmed into the autodial modems which emulate the remote user can be generated through the AM7. Decoded calls are generated to receiving modems that are emulating host computer sites. The receiving modems' answerback tones are generated through the speech and supervisory paths established in the AM7.

The AM7 can simulate a number of conditions against which an autodial modem can effectively be tested. Some examples are:

- Dial Tone
- Dial Tone Delay
- Second Dial Tone
- Line Busy
- Reorder
- Delays in Call Progress
- Reaction to Answerback Tone

5. REPORTS

The AM7 provides a variety of reports that are dependent upon selectable options. The reports are transmitted across an RS232C interface, requiring the connection of a compatible asynchronous serial ASCII terminal, or a modem and remote terminal. Reports are generated in a serial ASCII format and can be printed on any compatible ASCII printer, or displayed on any compatible CRT device. A PC can be used as the terminal device. This allows report information to be written directly to a floppy or hard disk for storage or statistical analysis.

Reports can be generated either automatically or manually (using Special Function selections).

5.1 Automatic Reports

The Power Status report is automatic and not selectable. Three Automatic Unit Data Register reports (Data Readout, Dial Pulse, and Tone Dial) are selected for generation during System Setup and Programming. The Dialing Code Error report is selected for generation during Line Setup and Programming. The following five reports can be generated automatically:

- Power ON and Power OFF- Automatic - No prompt response required
- Data Readout Report- YES (1) to Auto Print prompt
- Dial Pulse Report- YES (1) to Dial Pulse Report prompt
- Tone Dial Report- YES (1) to Tone Dial Report prompt
- Dialing Code Error Report- YES (1) to Dial Code Report prompt

5.1.1 Power ON and Power OFF Report

The Power ON and Power OFF Report is generated every time the AM7 is turned ON or OFF. Each event is time stamped.

```
POWER OFF AT: 06:56 05/14/97 POWER ON AT: 06:56 05/14/97
```

Figure 5-1. Power ON and Power OFF Report

5.1.2 Data Readout Report

When automatic printouts are selected, the Data Readout Report is generated every hour, on the hour. The Data Readout Report provides the Data Code Register status for each of the lines installed in the AM7. The report includes the total number of attempts (incoming Off Hooks), Dialing Code matches (A1-A8, B1-B8, C1-C8, or D1-D8) and calls where there was no code match with the expected digits.

```
DATA READOUT 06:54 05/14/97
LINE   ATT   CODE1  CODE2  CODE3  CODE4  CODE5  CODE6  CODE7  CODE8  NOCODE
 003  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
 004  18353  00875  17480  00875  17480  17480  00875  17480  00000  00873
 005  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
TOTL 018353 000875 017480 000875 017480 017480 000875 017480 000000 000873
```

Figure 5-2. Data Readout Report

When a Data Readout Report is generated for a T1 Span, additional information is contained in both the top and bottom of the printout. The Bipolar Violations (BPV), Frame Slips (SLIP), Framing Errors (FERR), and Cyclical Redundancy Check Errors (CRC) are provided for the selected Span.

At the end of the printout, the "TONE RECEIVER TRAFFIC DATA" indicates the number of MF and Touch Tone (TT) "RECEIVER OVERFLOWS" (no receiver of designated type available when first requested.

"ALL RECEIVERS BUSY USAGE" provides the total counts of the number of times receiver groups were busy at the time of sampling.

- When the AM7 is reset, all counters are set to 00000.
- Each group of each Receiver Card is sampled every 10 seconds.
- If all 3 or 4 receivers are busy when the group is sampled, the counter for that group is incremented.
- A running total is kept from the time of the last reset.

The "SLOT" indicates the card cage slot location of the Receiver Card. The left-hand five digits indicate Receiver Group "A" all-busy counts. The right-hand five digits indicate Receiver Group "B" all-busy counts.

DATA READOUT 06:54 05/14/97

SPAN: 1 BPV= 00000 SLIP= 00000 FERR= 00000 CRC= 00000

LINE	ATT	CODE1	CODE2	CODE3	CODE4	CODE5	CODE6	CODE7	CODE8	NOCODE
101	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
102	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
103	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
104	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
105	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
106	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
107	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
108	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
109	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
110	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
111	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
112	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
113	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
114	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
115	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
116	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
117	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
118	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
119	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
120	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
121	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
122	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
123	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
124	00000	00000	00000	00000	00000	00000	00000	00000	00000	00000
TOTL	000000	000000	000000	000000	000000	000000	000000	000000	000000	000000

TONE RECEIVER TRAFFIC DATA

RECEIVER OVERFLOWS: MF= 00000 TT= 00000

ALL RECEIVERS BUSY USAGE

SLOT

009 00000 00000

Figure 5-3. Data Readout Report (T1 Span 1)

5.1.3 Dial Pulse Report

The Dial Pulse Report consists of the speed, percent break, and interdigit timing. The report is issued for either ALL digits decoded by the AM7, or only for those where the selected parameter thresholds have been exceeded.

This report can be assigned to a specific line, or randomly assigned by the AM7 to the next busy line.

```
PULSE DIAL REPORT 07:01 05/14/97
LINE 004 - ALL DIGITS
   SPEED BREAK  ID-TIME
9  10.0   60%    ---
2  10.0   60%   600ms
3  10.0   60%   600ms
4  10.0   60%   600ms
5  10.0   60%   600ms
1  ----   --     ---
```

Figure 5-4. Dial Pulse Report

5.1.4 Tone Dial Report

When the Tone Dial Report is selected, and automatic reports are selected, a Tone Dial Report is generated for a line.

The Tone Dial Report consists of the LO and HI Band frequencies, percent of frequency deviation, frequency levels, twist, and ON and OFF (interdigit) times. The report is issued for either ALL digits decoded by the AM7, or only for those where the selected parameter thresholds have been exceeded.

This report can be assigned to a specific line, or randomly assigned by the AM7 to the next busy line.

```
 TT DIAL REPORT 06:59 05/14/97
 LINE 004 - ALL DIGITS
      LOW-BAND         HIGH-BAND     TWST  OFF    ON
   FREQ  DEV LEVEL  FREQ  DEV LEVEL        TIME   TIME
   (Hz)  (%) (dBm)  (Hz)  (%) (dBm)  (dB)  (mS)   (mS)
9  0852  0.0  -09   1476 -0.1  -09   +00   1047   0059
2  0697  0.0  -09   1336  0.0  -09   +00   0061   0060
3  0697  0.0  -09   1476 -0.1  -09   +00   0060   0060
4  0770  0.0  -09   1209  0.0  -09   +00   0060   0060
5  0770  0.0  -09   1336  0.0  -10   -01   0060   0060
1  0697  0.0  -09   1209  0.0  -09   +00   0641   0061
2  0697  0.0  -09   1336  0.0  -09   +00   0059   0060
8  0852  0.0  -09   1336  0.0  -09   +00   0060   0060
.  1000  ---* -22*  ----  ---   --    --   0079   1001
```

Figure 5-5. Tone Dial Report

5.1.5 Dialing Code Error Report

When the Dialing Code Error Report is selected, it is generated only when digits in addition to, or instead of, those expected are received by the AM7. It provides the line number associated with each dialing code error, the actual digits that were received, and the time and date.

```
LINE 004 DIALLING CODE ERROR @ 06:58 05/14/97. DIGITS = #
```

Figure 5-6. Dialing Code Error Report

5.2 Special Function Reports

5.2.1 Special Function 1 Report

The Special Function 1 Report prints all System, Line, or Dialing Code setup parameters associated with the selected area. The System report is printed by pressing SEL 000, SHIFT, SPCL, 1, then the ETR🡻 key. A Line report is printed by pressing SEL, the line number, SHIFT, SPCL, 1, then the ETR🡻 key. A Dialing Code report is printed by pressing SEL, the line number, a Dialing Code location (such as 0B3), SHIFT, SPCL, 1, then the ETR🡻 key.

```
SPCL FUNCTION  1;
LINE PARAMETERS 06:53 05/14/97
LINE 001
  START (DIAL TONE) DELAY: 00
  AUTOCODE: DISABLED
  CONFIRMING TONE: 0, (1010 HZ)
  HUNT GROUP: 1
  ANSWER SUPERVISION: ENABLED
  DIALLING CODE GROUP: A
  DIALLING CODE ERROR REPORT: ENABLED
  CALL PROGRESS TONE LEVEL: NORMAL
  DIALLING ACCEPTED: PULSE TONE
  EVENT RECOGNITION TIMES:
    DISCONNECT: 1000ms, FLASH: 0450ms
  WINK DURATION: 0250ms
LINE  ATT   CODE1  CODE2  CODE3  CODE4  CODE5  CODE6  CODE7  CODE8  NOCODE
 001 00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
```

Figure 5-7. Special Function 1 Report

5.2.2 Special Function 2 Report

The Special Function 2 Report prints ALL the parameters and data registers for ALL lines and Dialing Codes in the AM7. If the AM7 is equipped with all 20 lines and/or has all 32 Dialing Codes programmed, this report can be very lengthy. The report is selected by pressing SHIFT, SPCL, 2, then the ETR🡻 key.

```
SPCL FUNCTION  2;
UNIT PARAMETERS 07:02 05/14/97
AUTOMATIC DATA READOUT: ENABLED
DIAL TONE
  CONTINUOUS
  TONE A: -13dBm-0350Hz, TONE B :-13dBm-0440Hz
RING
  FREQUENCY: 20.0Hz
  CADENCE: 2000-4000, 0000-0000 ms
RINGBACK
  CADENCE: 2000-4000, 0000-0000 ms
  TONE A: -19dBm-0440Hz, TONE B :-19dBm-0480Hz
LINE BUSY
  CADENCE: 0500-0500, 0000-0000 ms
  TONE A: -24dBm-0480Hz, TONE B :-24dBm-0620Hz
REORDER
  CADENCE: 0200-0300, 0000-0000 ms
  TONE A: -24dBm-0480Hz, TONE B :-24dBm-0620Hz
TONE DIAL ANALYZER: ENABLED
  LEVEL LIMITS, LOW FREQ: -18:-06dBm, HIGH FREQ: -18:-06dBm
  TWIST LIMITS, -06:+06 dB, FREQUENCY VARIATION: 01.5%
  MINIMUM ON-OFF TIMES: 35-35ms, GUARD TIME: 20ms
  RANDOMLY ASSIGNED, ALL EVENTS
DIAL PULSE ANALYZER: ENABLED
  SPEED LIMITS: 08 - 12PPS, BREAK LIMITS: 50 - 70%
  MINIMUM INTERDIGIT TIME: 0400
  RANDOMLY ASSIGNED, ALL EVENTS
CONNECTION LOSS: 06dB
MASTER SPAN: 1
TONE RECEIVER MODES
  SLOT 09 TT,TT
BAUD RATE: 9600, PARITY IS EVEN
```

```
DIALING CODES 07:06 05/14/97
0A1 99999--     , 09;00
0A2 8189155441  , 07;04
0A3 917145551212, 16;01
•
•
•
•
0A8

0B1 3333333     , 06;00
0B2 4444444     , 05;05
0B3 5555555     , 16;04
         (ETC.)
```

Figure 5-8. Special Function 2 Report

5.2.3 Special Function 3 Report

The Special Function 3 Report is similar to the Data Readout report in that it prints ALL the data registers for each line in the AM7, but may be printed at any time. The report is selected by pressing SHIFT, SPCL, 3, then the ETR↓ key. If the AM7 is equipped with all 20 lines, this report can also be very lengthy.

```
SPCL FUNCTION  3;
DATA READOUT 06:54 05/14/97
LINE   ATT   CODE1  CODE2  CODE3  CODE4  CODE5  CODE6  CODE7  CODE8  NOCODE
 003  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
 004  18353  00875  17480  00875  17480  17480  00875  17480  00000  00873
 005  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
 006  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
 007  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
 008  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
 009  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
 010  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
 011  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
 012  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
TOTL 018353 000875 017480 000875 017480 017480 000875 017480 000000 000873
```

Figure 5-9. Special Function 3 Report

5.2.4 Special Function 4

Special Function 4 resets ALL data registers for ALL lines installed in the AM7. There is no printed report associated with this function. It is selected by pressing SHIFT, SPCL, 4, then the ETR↓ key.

5.2.5 Special Function 5

Special Function 5 resets ALL data registers for the selected line (000-020, 101-124, 201-224, 301-324, 401-424) in the AM7. There is no printed report associated with this function. It is selected by pressing SEL, the line number (such as 001), SHIFT, SPCL, 5, then the ETR↓ key.

5.2.6 Special Function 6

Special Function 6 stores System, Line, and Dialing Code parameters for later recall. When a testing scenario has been entered, with all the System, Line, and Dialing Code parameters in place, it may be stored in one of four areas in an EPROM in the AM7 for later recall. Up to 4 different scenarios may be stored at one time. When a specific scenario is required, it may simply be recalled, rather than requiring a lengthy data entry process. There is no printed report associated with this function. It is selected by pressing SHIFT, SPCL, 6, then the ETR↓ key. A "STORE" prompt appears. Enter the number of the area that the scenario information is to be stored in (1-4) and press the ETR↓ key.

```
STORE                4
```

5.2.7 Special Function 7

Special Function 7 recalls previously stored System, Line, and Dialing Code parameters from the AM7's memory. There is no printed report associated with this function. It is selected by pressing SHIFT, SPCL, 7, then the ETR↓ key. A "RECALL" prompt appears. Enter the number of the area that the scenario information is to be recalled from (1-4) and press the ETR↓ key. A "RECALL" entry of "0" restores the AM7 to factory default parameters.

```
RECALL               4
```

5.2.8 Special Function 8 Report

The Special Function 8 Report prints the Dialing Codes for all installed lines. Only if there are any analog lines installed will any of the "0" series (0A1, 0A2, 0A3, etc.) dialing codes be printed. Only if there is a Span 3 (PCM or DLC card) will the "3" series (3A1, 3A2, 3A3, etc.) dialing codes be printed. It is selected by pressing SHIFT, SPCL, 8, then the ETR🡣 key.

```
SPCL FUNCTION 8;
DIALING CODES 07:36 05/14/97
0A1 99999--     , 09;00
0A2 8189155441  , 07;04
0A3 917145551212, 16;01
•
🡣
•
0A8

0B1 3333333     , 06;00
0B2 4444444     , 05;05
0B3 5555555     , 16;04
•
🡣
3A1 99999--     , 09;00
3A2 8189155441  , 07;04
3A3 917145551212, 16;01
•
🡣
•
3A8

3B1 3333333     , 06;00
3B2 4444444     , 05;05
3B3 5555555     , 16;04
         (ETC.)
```

Figure 5-10. Special Function 8 Report

5.2.9 Special Function 9 Report

The Special Function 9 Report is similar to the Special Function 3 Report in that it prints the data registers for each line in the AM7. The Special Function 9 Report however, prints data for the selected line only. The report is selected by pressing SEL, the line number (such as 007), SHIFT, SPCL, 9, then the ETR↓ key.

```
SPCL FUNCTION  9;
DATA READOUT 08:14 05/14/97
LINE   ATT   CODE1  CODE2  CODE3  CODE4  CODE5  CODE6  CODE7  CODE8  NOCODE
 007  18353  00875  17480  00875  17480  17480  00875  17480  00000  00873
TOTL 018353 000875 017480 000875 017480 017480 000875 017480 000000 000873
```

Figure 5-11. Special Function 9 Report

6. CHAINING AND REMOTE CONTROL OPERATION

6.1 Chaining

Multiple AM7's can be "chained together to increase the flexibility and capacity of the unit and to provide a single point of common control and programming. A maximum of 15 units can be cabled (chained) together in any required configuration.

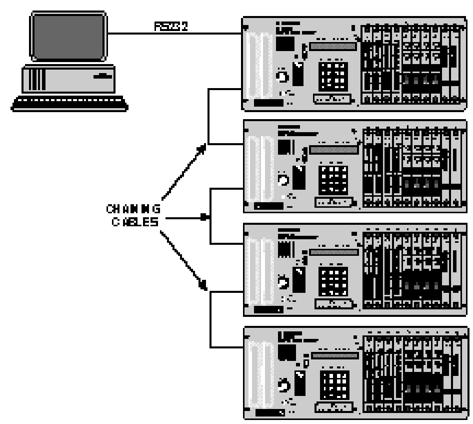


Figure 6-1. Chaining of AM7 Units

The RS-232C interface is used to interconnect multiple units together with the Chaining Cable. Each unit can be individually programmed and controlled from its keypad, or any of the units that are chained together can be addressed through the RS-232C interface. Units are designated as Unit A (#1) through Unit O (#15) and addressed from the control terminal equipment by typing an exclamation point (!) before the unit's address. For example, to access the third unit in a chain, enter !C.

Multiple AM7's can also be interconnected for the purpose of creating an intermachine trunk between units. E&M Interface Port cards in the units to be tied together are connected with the Interoffice E&M Cable.

It is important to note that the AM7 can only switch calls within an individual system, unless it is configured with a simulated interoffice trunk facility. When multiple AM7's are tied together in this manner, calls can be directed over the intermachine trunk facility and processed by other AM7's. Keep in mind that the maximum capacity of 15 units relates only to the chaining of multiple systems for common RS-232C control and functionality.

6.2 Remote Control Operation

6.2.1 RS-232C Interface

Each AM7 is equipped with an EIA RS-232C digital interface compatible with most serial ASCII printers, CRT's, Personal Computers (PC's), and modems. Certain pins used in the 25-pin DB connector must be tied together for proper system operation. Additionally, the printer or CRT may have unique strapping requirements. The Ameritec Universal Printer Cable can be used for this purpose.

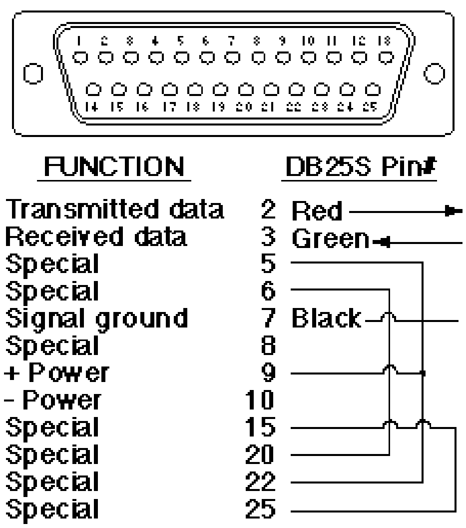


Figure 6-2. Universal Printer Cable

Connect the AM7 to the RS-232C device with the Ameritec Universal Printer Cable. Obtain the RS-232C device's data rate and parity settings and verify that they are compatible with the AM7.

To verify the Baud and Parity settings, turn the AM7 ON and press the SEL,A key on the Program Keyboard. SELECT 000 is displayed. Press the ETR↓,B key. The Clock Display appears. Press SHIFT + ETR↑, 3 key three times to display the BAUD Rate parameter. The factory data rate default is 300 bps. To change the rate, simply enter the desired speed and press the ETR↓,B key. The next prompt displayed is for the Parity selection. Select 0 for even parity or 1 for odd parity, followed by the ETR↓,B key.

6.2.2 Terminal Operation

Operation of the AM7 via an ASCII terminal is very similar to operations using the AM7's Program Keyboard. For each key on the Program Keyboard, there is a key on the terminal's keyboard that performs the same function. Since there are many more keys available on a terminal's keyboard, there are some alternate key assignments (designated as "or") provided for convenience. Unless data is being entered into registers (such as an expected digit field), characters entered from the terminal should be in UPPER CASE. There are a number of special functions provided to take advantage of the terminal's ability to display more than one line of information. These functions allow an entire menu of parameters, or set of data registers, to be viewed in a single display.

Program Keyboard	Terminal Keyboard
0 - 9	0 - 9
*	*
#	#
SEL,A	A
ETR↓,B	B or <CR>
ETR→,C	C or <LF>
SHIFT	D
SHIFT 1,ESC	D1 or E
SHIFT ETR↑, 3	D3 or ^
SHIFT 5,COPY	D5
SHIFT 6,SPCL	D6
SHIFT 8,FLASH	D8 or F
SHIFT *(|),NEG (-)	D* or -
SHIFT 0,BLANK	D0 or <SP>
SHIFT SEL,A	DA or a
SHIFT ETR↓,B	DB or b
SHIFT ETR→,C	DC or c
SHIFT D	DD or d

Figure 6-3. AM7/Terminal Key Equivalents

The "A" key on the terminal's keyboard operates in the same manner as the SEL,A key on the AM7's Program Keyboard. It permits the selection of the System, Line, or Dialing Code menu.

6.2.2.1 System Menu

The System Menu is the means by which the System Setup Parameters may be reviewed, observed, output, or changed. To select the System Menu, press the <A> key on the keyboard of the ASCII terminal device to be used for RS232C control. The remote display should show

SELECT 000;

This prompt means that the AM7 is ready to display the System Setup parameters. Each parameter can be viewed sequentially by pressing either the <CR> (carriage return) key or the <B> key. When under RS232C terminal control, the <B> key on the ASCII keyboard is equivalent to the ETR↓,B key on the AM7's keypad.

> **Note:** Press the <D> and <3> keys on the keyboard to step backward through the prompts. The <D3>, or the ^ key command, is equivalent to the SHIFT and ETR↑ key on the AM7's keypad.

```
SELECT       000;
CLOC 1338 051497;
AUTO PRT NO=0  1;
RING FRE    35.0;
RING 1 2000:4000;
RING 2 0000:0000;
RB 1   2000:4000;
RB 2   0000:0000;
LB 1   0500:0500;
LB 2   0000:0000;
RO 1   0200:0300;
RO 2   0000:0000;
TD RPT Y=1 N=0 1;
TD LO    -06 -15;
TD HI    -06 015;
TD TWIST -06  06;
TD FRE       1.5;
TD ON-OFF  40-40;
TD GUARD      20;
TD R=1 F=2     1;
TD ALL Y=1 N=0 1;
DP RPT Y=1 N=0 1;
DP SPEED   08-12;
DB BREAK   50-70;
DP ID TIME   400;
DP   R=1 F=2   1;
DP ALL Y=1 N=0 1;
CONN LOSS     06;
BAUD        0300;
PARITY  ODD=1  0;
VERSION      NNA;
```

Figure 6-4. System Menu

To obtain a printout or display of the System parameters, press either the <B> or <CR> keys on the keyboard. The System parameter display will appear.

The display may also be obtained by using Special Function 1. Enter <A>, <0>, <0>, <0>, and <CR> to select the System Parameter Menu, then enter <D>, <6>, <1>, and <CR> to activate Special Function 1.

6.2.2.2 Line Menu

The Line Menu is the means by which the Line Setup Parameters may be reviewed, observed, output, or changed. To manually display the line parameters, enter <A>, the line number, then <B> (or <CR>). To automatically display the line parameters for each line, enter <A>, the line number, <B>, then the special function command <D61B>. For example, to select Line 002 and display its parameters, enter <A>, <02>, <B>, then <D61B>.

```
SELECT       001;
SELECT       001;002
START DELAY   00;
SPCL FUNCTION  1;
SPCL FUNCTION  1;1;
LINE PARAMETERS 06:53 05/14/97
LINE 002
  START (DIAL TONE) DELAY: 00
  AUTOCODE: DISABLED
  CONFIRMING TONE: 0, (1010 HZ)
  HUNT GROUP: 1
  ANSWER SUPERVISION: ENABLED
  DIALLING CODE GROUP: A
  DIALLING CODE ERROR REPORT: ENABLED
  CALL PROGRESS TONE LEVEL: NORMAL
  DIALLING ACCEPTED: PULSE TONE
  EVENT RECOGNITION TIMES:
    DISCONNECT: 1000ms, FLASH: 0450ms
  WINK DURATION: 0250ms
LINE   ATT   CODE1  CODE2  CODE3  CODE4  CODE5  CODE6  CODE7  CODE8  NOCODE
 001  00000  00000  00000  00000  00000  00000  00000  00000  00000  00000
```

Figure 6-5. Line Menu

6.2.2.3 Dialing Menu

The Dialing Menu allows the Dialing Code Parameters to be reviewed, observed, output, or changed. To manually display the Dialing Code parameters, enter <A>, <D>, the Dialing Code number, then <B> (or <CR>). To automatically display the Dialing Code parameters for each line, enter <A>, <D>, the Dialing Code number, <B>, then the special function command <D61B>.

```
SPCL FUNCTION  1;
DIALLING CODES 06:53 05/14/97;
0A1 92345        , 15;00;
0A2 128          , 08;01;
0A3 123          , 16;01;
0A4 13           , 06;00;
0A5 999----      , 15;00;
0A6 128          , 08;01;
0A7 ###          , 07;01;
0A8;
↓
ETC.
```

Figure 6-6. Dialing Code Menu

For example, to display all the Dialing Codes, enter <A>, <D>, <0A1>, <B>, then <D61B>.

Only those Dialing Codes that have been entered will be output to the display, along with their step sequences.

6.2.3 Special Functions

Type <D>, then <6> to activate the AM7's special functions control. Then type <N>, where <N> equals the special function number.

Table 6-1. Terminal Keyboard Special Functions

Special Function	Description
D61	Print parameters associated with the selected AREA. Includes System, Line, and Dialing Codes.
D62	Print all parameters and data registers.
D63	Print data registers.
D64	Reset all data registers.
D65	Reset selected line (001-020, 101-124, 201-224, 301-324, 401-424) data registers.
D66	Store up to four (4) System, Line, and Dialing Code parameter scenarios for later recall.
D67	Recall up to four (4) previously stored System, Line, and Dialing Code parameter scenarios from memory. Recall 0 restores the AM7 to factory default parameters.
D68	Print Dialing Codes for all installed analog lines or Spans.
D69	Print data for the selected analog line or the selected Span.

6.2.4 Help Displays

There are several HELP displays available when using an ASCII terminal to control the AM7. The AM7 HELP Menu is obtained by typing a question mark (?).

The following HELP displays are available when the appropriate digit is typed in:

<0> TO LEAVE HELP

<1> FOR GENERAL HELP

<2> FOR UNIT PARAMETER HELP

<3> FOR LINE (PORT) PARAMETER HELP

<4> FOR DIALING CODE AND STEP HELP

<5> FOR SPECIAL FUNCTION HELP

7. TECHNICAL SPECIFICATIONS

7.1 System

7.1.1 Capacity

Ten (10) option card slots. Each slot can accommodate any of the following:

1. **Line Cards**
   - Analog: 2 loop/ground start lines.
   - Analog: 2 E&M lines. Types I, II, III, IV, and V.
   - T1: One span (max. 4 SLC®96 or T1).
   - SLC®96: One span.
2. **Tone Decoders (max. of 7 per unit)**

   Used for Tone Dial Decoding on PCM and DLC cards only.
   - DTMF: 6 TT decoders.
   - MFR1: 8 MFR1 decoders.

7.1.2 Simultaneous Calls

Non-Blocking switching for any combination of connections.

7.1.3 Busy Hour Call Volume

Up to 48,000 calls/hour.

7.1.4 Chaining

Up to 15 AM7 units may be chained and controlled via RS-232 interface or print to a serial printer.

7.1.5 Signaling Systems

1. **Analog:** Loop Start or Ground Start.
2. **T1:** E&M, Wink Start, Delay Dial, Dial Tone Start, Immediate Start, Loop Start, Ground Start, and ESF.
3. **SLC®96:** Universal Voice Grade (Mode I) and Single Party (Modes I and II). Complies with Bellcore TR-TSY-000008.
4. **Dialing:** Dial Pulse, DTMF, or MFR1.
5. **Dialing Codes:** 4 groups of 8 for each line.

7.2 Detectors

7.2.1 Analog Loop/Ground Start

Loop current, Ring trip, Ring ground, and per line DTMF decoder.

7.2.2 Analog E&M

E Lead and per line DTMF or MFR1 decoder.

7.2.3 T1/SLC®96

A/B signaling bits, per channel dial pulse decoder, and optional shared DTMF/MFR1 digit decoders.

7.3 Digit Decoders

7.3.1 DTMF

1. **On/Off Time:** 40 mS min.
2. **Twist:** +/-9dB.
3. **Frequency Variation:** +/-1.5% accept, +/-3.5% reject.
4. **Level:** 0dBm to -24dBm per tone (40mS On/Off, 0dB Twist, 0Hz Frequency Variation), and 0dBm to -6dBm per tone (40mS On/Off, +/-9dB Twist, +/-1.5% Frequency Variation).

7.3.2 MF(R1)

1. **KP Digit On/Off Time:** 55/20 mS accept, and 30/10mS reject.
2. **All Other Digits:** 30/20 mS accept, and 10/10mS reject.
3. **Twist:** +/-6dB max.
4. **Frequency Variation:** +/-1.5%.
5. **Level:** 0dBm to -25dBm per tone.

7.3.3 Dial Pulse

1. **Maximum Speed:** 13.3pps @ 80% break; 26.6pps @ 40% break; and 3.3pps @ 50% break.
2. **Minimum Speed:** 5.2pps @ 80% break; 3.9pps @ 40% break; and 3.3pps @ 50% break.
   - Break: 13-75% @ 5pps; 16-84% @ 10pps; and 40-60% @ 25pps.
3. **Minimum Interdigit Timing:** 100mS @ 5pops, 60% break; 140mS @ 10pps, 60% break; and 164mS @ 25pps, 60% break.

7.4 Digit Analyzer

7.4.1 Tone Dialing

TMS320 DSP measures level, frequency, on/off timing, Twist, and Skew of DTMF or MF(R1) digits.

7.4.2 Pulse Dialing

Speed, % break, and interdigit timing.

7.5 Tone Generators

7.5.1 Call Progress Tones

1. **Dial Tone Cadence:** On/Off times from 0-9900mS.
2. **Dial Tone Level:** -3dBm to -39dBm in 1dBm steps, programmable per tone.
3. **Dial Tone Freq.:** 200Hz to 3500Hz in 10Hz steps, programmable per tone.
4. **Dial Tone Generation:** 240-380 ms (fixed).
5. **Ring Frequency:** 15.0Hz to 35.0Hz in 0.1Hz steps.
6. **Ring Cadence:** 2 ringing sequences (Ring 1 and Ring 2). Ring 1 programmable from 100mS to 9900mS in 100mS steps. Ring 2 programmable from 0mS to 9900mS in 100mS steps.
7. **Ringback Tone Cadence:** 2 ringback sequences (Ringback 1 and Ringback 2). Ringback 1 programmable from 100mS to 9900mS in 100mS steps. Ringback 2 programmable from 0mS to 9900mS in 100mS steps.
8. **Ringback Level:** -3dBm to -39dBm in 1dB steps, programmable per tone, including Quiet.
9. **Ringback Freq.:** 200Hz to 3500Hz in 10Hz steps, programmable per tone.
10. **Line Busy Tone Cadence:** 2 line busy sequences (Line Busy 1 and Line Busy 2). Line Busy 1 programmable from 100mS to 9900mS in 100mS steps. Line Busy 2 programmable from 0mS to 9900mS in 100mS steps.
11. **Line Busy Level: -**3dBm to -39dBm in 1dB steps, programmable per tone, including Quiet.
12. **Line Busy Frequency:** 200Hz to 3500Hz in 10Hz steps, programmable per tone, including Quiet.
13. **Reorder Tone Cadence:** 2 reorder sequences (Reorder 1 and Reorder 2). Reorder 1 programmable from 100mS to 9900mS in 100mS steps. Reorder 2 programmable from 0mS to 9900mS in 100mS steps.
14. **Reorder Tone Level:** -3dBm to -39dBm in 1dB steps, programmable per tone, including Quiet.
15. **Reorder Frequency:** 200Hz to 3500Hz in 10Hz steps, programmable per tone.

7.5.2 Confirming Tones

Any line can generate one of the following single tones at -6dBm as part of a Step Sequence:

- 900Hz
- 1010Hz
- 1150Hz
- 1280Hz
- 1400Hz
- 1530Hz
- 1650Hz
- 1780Hz
- 1900Hz
- 2030Hz
- 2150Hz
- 2280Hz
- 2400Hz

7.5.3 SIT Tones

Any line can generate one of the following 6 SIT tones at -6dBm as part of an Action Sequence:

1. **Vacant Code:** 980Hz, 1370Hz, and 1780Hz.
2. **No Circuit-BOC:** 980Hz, 1430Hz, and 1780Hz.
3. **Intercept:** 910Hz, 1370Hz, and 1780Hz.
4. **Reorder-BOC:** 910Hz, 1430Hz, and 1780Hz.
5. **Reorder-Carrier:** 980Hz, 1370Hz, and 1780Hz.
6. **No Circuit-Carrier:** 910Hz, 1370Hz, and 1780Hz.

7.6 Signal/Power Sources

7.6.1 Loop Voltage (2W Analog)

-48VDC +5% open circuit.

7.6.2 Ring Generator

Sine wave, variable 15.0Hz to 35.0Hz, 60Vrms open circuit, 40Vrms with 2REN load.

7.7 Miscellaneous

7.7.1 Frequency Response

Less than 0.7dB attenuation distortion from 300Hz to 3300Hz.

7.7.2 Connection Loss

Programmable from 0dB to 14dB in 1dB steps.

7.7.3 T1/SLC®96 Interfaces

Bantam connectors for each span. 8kHz Clock Source: internal 8kHz reference for span 1-4.

7.7.4 User Interface

16 button keypad, and 16 digit alphanumeric LED display.

7.7.5 RS232C/V.24 Port

Serial, asynchronous, ASCII code at 300/1200/2400/4800/9600 baud, Odd or Even parity, 7 Data Bits, 2 Stop Bits, and full duplex on 3 wires (DB25P).

7.7.6 Audio Monitor

Built-in monitor and loudspeaker.

7.7.7 Non-Volatile Memory

4 non-volatile memory sets for numbers and parameters. Active parameters are saved with power removed for up to 30 days.

7.8 Power

- 108-125VAC, 50/60Hz
- 210-230VAC, 50/60Hz, 50W max.

7.9 Dimensions

Compact and Portable

16.8"L x 7.2"W x 11.5"H

18 lb.

8. WARRANTY, CALIBRATION, AND SERVICE

8.1 Warranty

Ameritec Corporation warrants that its electronic instrument products are manufactured to the highest commercial standards and are free from any defects in material or workmanship. For a period of one (1) year from shipment, Ameritec will repair, without charge to the original purchaser, any unit which upon inspection by Ameritec proves to be defective.

This warranty is the sole warranty offered by Ameritec and is in lieu of all other obligations or liabilities, including claims of consequential damage; however, an EXTENDED WARRANTY PLAN may be purchased. For information, contact an Ameritec Sales Representative.

8.2 Service Policy

Ameritec products are designed with plug-in printed circuit boards and modular assemblies. Once a problem is localized, service is accomplished by PC board (or module) replacement.

8.3 Calibration Policy

All Ameritec products are manufactured to commercial standards and are calibrated with equipment traceable to NIST (National Institute of Standards and Technology). With the exception of component failures or abuse, Ameritec instruments are designed to maintain compliance with their published specifications throughout their service life.

While periodic calibration verification is normally not required, in critical applications it is recommended that verification be accomplished annually.

Calibration verification is most efficiently accomplished by return of the equipment to the Ameritec factory where specialized test equipment is used. Field calibration verification is not supported by Ameritec.

8.4 Return of Unit

In the event of a malfunction, call or write to the Ameritec factory and obtain a return authorization number. Return the unit to Ameritec, freight prepaid, with a note (in-warranty repair) or a Purchase Order for the repair (out-of-warranty repair) listing the following information:

- Return authorization number from Ameritec.
- Return shipment address of purchaser.
- Name and telephone number of person at purchaser's location familiar with the problem.
- Brief description of problem (include any printouts that may have a bearing on the problem, if possible).
- Terms of payment for repair costs (out-of-warranty unit).

The unit will be repaired and returned freight-prepaid for units in warranty and freight-collect for units out-of-warranty. As stated above, a Purchase Order to cover the cost of repair must accompany any out-of-warranty return of the unit to Ameritec.

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9. GLOSSARY

The glossary contains an acronyms list. The acronym list is a two column table. Column One lists the acronyms used in this manual. Column Two lists the extended or complete phrase from which the acronym in Column 1 was derived. Occasionally a short definition is provided.

ACRONYM	COMPLETE TERM or DEFINITION
AC	Alternating Current
AL	All
ANI	Automatic Number Identification
ASCII	American Standard Character Set
ATT	Attempts
AUTO	Automatic
BOC	Bell Operating Company
Bps	Bits per second
BPV	BiPolar Violation
BREAC	Break
CLOC	Clock
CO	Central Office
CON	Continuous
CONF	Confirming
CONN	Connection
COT	Central Office Terminal
CPE	Customer Premises Equipment
CRC	Cyclical Redundancy Check
CRT	Cathode Ray Tube

ACRONYM	COMPLETE TERM or DEFINITION
dB	decibels
DB-25	Standard 25-pin connector
dBm	decibels relative to 1 mw
DC	Dialing Code; Direct Current
DEV	Deviation
DIP	Dual In-line Package
DISC	Disconnect
DLC	Digital Loop Carrier
DP	Dial Pulse
DSP	Display System Protocol
DT	Dial Tone
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi-Frequency
E & M	Ear and Mouth Signaling
EIA	Electronic Industries Association
EPROM	Erasable Programmable Read Only Memory
ERR	Error
ESC	Escape
ESF	Extended Superframe Format
ETR	Enter
F	Frequency; Fixed
FELP	Far End Loop
F ERR	Frame Error
FRE	Frequency

ACRONYM	COMPLETE TERM or DEFINITION
Freq	Frequency
HI	High
Hz	Hertz (cycles per seconds)
ID	Interdigit
INT	Interrupted
KP	Multi-Frequency receiver enabler
L	Level
LB	Line Busy
LED	Light Emitting Diode
LO	Low
MF	Multi-Frequency R1
Misc	Miscellaneous
MON	Monitor
ms	millisecond
NEG	Negative
NIST	National Institute of Standards & Technology
NOR	Normal
OFL	Overflow
PABX	Private Automatic Branch Exchange
PBX	Private Branch Exchange
PC	Personal Computer
PCM	Pulse Code Modulation
ppm	pulses per minute
pps	pulses per second

ACRONYM	COMPLETE TERM or DEFINITION
PRT	Print
R	Random
RB	Ringback
REC	Receiver
RO	Reorder
RPT	Report
RS-232C	Electrical and Mechanical Interface Standards
RT	Remote Terminal
SEL	Select
SIG	Signal
SIT	Special Information Tone
SLC®96	Registered AT&T Loop Code Specification
SPCL	Special
ST	Multi-Frequency receiver disabler
SUPU	Supervision
SW	Switch
T1	Digital transmission link
TCA	Trunk Assignment
TD	Tone Dial
TMS	Time Multiplexed Switch
TON	Tone
TOTL	Total
TT	Touch Tone
TWST	Twist

ACRONYM	COMPLETE TERM or DEFINITION
VAC	Volts Alternating Current
VDC	Volts Direct Current
WINC	Wink

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